Gateway Village Rehabilitation Project

Fort Hancock and the Sandy Hook Proving Ground
Monmouth County, NJ

TRAFFIC IMPACT STUDY

Prepared for
NATIONAL PARK SERVICE

Prepared by
JE/Sverdrup & Parcel Consultants, Inc.

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TABLE OF CONTENTS

Executive Summary……..……E-1
1. Introduction....1-1
1.1. Purpose of this Traffic Study 1-1
1.2. Proposed Action....1-1
2. Background 2-1
2.1. Regional Context and Local Significance 2-1
2.2. Route 36 Corridor....2-3
3. Existing Conditions....3-1
3.1. Highway Classifications....3-1
3.2. Posted Travel Speeds 3-1
3.3. Geometry 3-1
3.3.1. Broad Street/Route 36 3-1
3.3.2. Main Street/Route 36 (Belford)....3-1
3.3.3. First Avenue/Route 36 3-2
3.3.4. Navesink Avenue/Route 36....3-2
3.3.5. Miller Street/Route 36 3-3
3.3.6. County Route 520/Route 36....3-3
3.3.7. Route 36 Bridge 3-4
3.4. Traffic Volumes 3-5
3.4.1. AM Peak Hour (7:30 AM – 8:30 AM) (July) 3-5
3.4.2. PM Peak Hour (4:45 – 5:45 PM) (July) 3-6
3.5. Levels of Service (LOS) 3-14
3.5.1. Weekday Conditions 3-14
3.5.2. Weekend Conditions....3-15
3.6. Transit Service 3-19
3.6.1. Ferry....3-19
3.6.2. Bus....3-19
3.7. Recent Activities at Fort Hancock....3-20
3.7.1. Summer Leasing Program 3-20
3.7.2. Events 3-21
3.8 Parking....3-21
4. Future Conditions 4-1
4.1. Adjustments to Existing Volumes 4-1
4.2. Future No-Build Traffic Volumes 4-1
4.2.1. Background Growth 4-1
4.2.2. Planned Development....4-1
4.3. Alternatives Analysis 4-11
4.3.1. Alternative 1 – Future Null with Existing Bascule Bridge....4-11
4.3.2. Alternative 2 – Build Condition (Fort Hancock Gateway Village)....4-16
4.3.3. Alternative 3 – Build Condition with Enhanced Bus Transit....4-27
4.3.4. Alternative 4 – Build Condition with Ferry Service Usage 4-27
4.3.5. Traffic Operations on the Bridge 4-27
4.3.6. Local Street Diversion....4-28
5. Conclusion....5-1

List of Figures and Tables

Page No.

Figure 1-1 Intersection Location Map E-4

Figure 1-2 Development Map, Gateway National Recreation Area 1-3
Figure 1-3 Development Map, Areas of Proposed Action Fort Hancock and Proving Ground Zones 1-4

Figure 2-1: Project Area Location Map 2-2

Figure 3-1 AM Existing Summer Weekday 3-8
Figure 3-2 PM Existing Summer Weekday 3-10
Figure 3-3 PM Existing Summer Weekend 3-12
Table 3-1 Existing Traffic Operations Weekday AM Peak Hour 3-16
Table 3-2 Existing Traffic Operations Weekday PM Peak Hour 3-17
Table 3-3 Existing Traffic Operations Weekend PM Peak Hour 3-18

Figure 4-1 AM No Build Summer Weekday 4-3
Figure 4-2 PM No Build Summer Weekday 4-5
Figure 4-3 PM No Build Summer Weekend 4-7
Figure 4-4 AM Build Summer Weekday 4-21
Figure 4-5 PM Build Summer Weekday 4-23
Figure 4-6 PM Build Summer Weekend 4-25

Table 4-1 No Build Traffic Operations Weekday AM Peak Hour 4-13
Table 4-2 No Build Traffic Operations Weekday PM Peak Hour 4-14
Table 4-3 No Build Traffic Operations Weekend PM Peak Hour 4-15
Table 4-4 Build Traffic Operations Weekday AM Peak Hour 4-18
Table 4-5 Build Traffic Operations Weekday PM Peak Hour 4-19
Table 4-6 Build Traffic Operations Weekend PM Peak Hour 4-20
Table 4-7 Average Vehicle Delay Resulting from Bridge Opening 4-30

List of Appendices:

Appendix A: Adaptive Use of Fort Hancock and the Sandy Hook Proving Ground
Appendix B: Ferry Service
Appendix C: Intersection Geometry and Photos
Appendix D: Signal Timing Plans
Appendix E: Route 36 Bridge Over Shrewsbury River
Appendix F: November 2002 Turning Movement/ATC Counts
Appendix G: NJDOT Permanent Count Stations
Sea Bright, NJ, Seasonal Adjustment Factors
Appendix H: Officerís ROW Summer Lease Program
Appendix I: Sandy Hook Park, Toll Plaza Volumes
Appendix J: NJDOT Pavement Design Data
Appendix K: Trip Assignments for Planned Development Projects Surrounding the Route 36 Corridor
Appendix L: Project Trip Generations
Appendix M: NJDOT Signalized Intersection Standards
Appendix N: HCS Worksheets
Appendix O: Letter dated November 8, 2002 from NJDOT to Nicole Granger at Jacobs, Sverdrup & Parcel Consultants, Inc. Re Police Accident Reports

Note: The appendices are not included in the on-line version of this document.
For a printed copy of the appendices, please call (732) 872-5910 or write to:
Superintendent, Sandy Hook, P.O. Box 530, Fort Hancock, NJ 07732

Executive Summary

Background

In February of 2002, the National Park Service (NPS) issued an Environmental Assessment evaluating potential impacts resulting from the Gateway Village Rehabilitation Project. This project will be an adaptive use of Fort Hancock and the Sandy Hook Proving Ground. This report expands on the traffic discussion in the Environmental Assessment; and is based on supplemental traffic count collection, review of additional planned developments, and additional traffic analysis.

Project Scope

Six intersections along State Route 36 (Route 36) and the Route 36 Bridge over Shrewsbury River were selected as the key locations to estimate potential traffic impacts generated by the project (see Figure 1).

The intersections include:

1. Broad Street in Keyport
2. Main Street in Middletown
3. First Avenue in Atlantic Highlands
4. Navesink Avenue in Highlands
5. Miller Street in Highlands
6. Route 520 in Sea Bright

In addition, the operation of the Route 36 Highlands Bridge was examined under three "future bridge" scenarios, including:

1. No-Build (maintain the existing movable bascule bridge with its 35 foot vertical clearance)
2. Build a new movable bascule bridge with a 55 foot vertical clearance
3. Build a new fixed bridge with a 65 foot vertical clearance

Methodology

The project was undertaken during the months of November and December 2002. Traffic data were collected along Route 36 between November 6 (Wednesday) and November 18, 2002. The data were collected from automatic traffic recorders (ATR's) and manual-turning movement counts (See Appendix F, November 2002 Turning Movement/ATR Counts). According to traffic data collected by the New Jersey Department of Transportation (NJDOT), the heaviest traffic flows along the corridor occur in July. Data collected at the Sandy Hook Park toll plaza show that the heaviest park usage also occurs in July (See Appendix I, Sandy Hook Park, Toll Plaza Volumes). The November (off-season) counts were seasonally adjusted to July volume levels in order to present a "worst case summer condition" analysis. The volume adjustment was

performed by using a combination of data from an NJDOT permanent count station (Station # 6-1-20) along Route 36 in Sea Bright, and ATR data collected near the Route 36 Highlands Bridge in August/September 2001 (Route 36 Bridge over the Shrewsbury River Feasibility Assessment Report, August/September 2001). The 12 months of data collected at the Sea Bright permanent count station are presented in Appendix G, NJDOT Permanent Count Stations Sea Bright, NJ, Seasonal Adjustment Factors. The estimations were made separately for each direction. November volumes were adjusted to represent July volumes by multiplying the 2002 November volumes by the appropriate seasonal adjustment factor according to industry standards (See Appendix G).

To obtain future conditions, a background rate of growth was applied to 2002 data. Information was obtained from Monmouth County Planning Department regarding approved additional developments that could add to the traffic volumes. Trip generation rates were obtained for these projects and added to the future volume projections. The Fort Hancock Rehabilitation was translated into expected generated trips and those volumes were added to the highway network as well. Finally, traffic under the future build condition was compared to the no-build condition to estimate the project impact on traffic at the studied intersections.

The latest version of the Highway Capacity Manual was used to analyze intersection performance. A traffic queuing model, specifically developed for the Highlands Bridge Feasibility Analysis for NJDOT, was used to analyze delays at the Highlands Bridge.

Impacts to Intersections

With respect to the six representative intersections, the analysis indicated that the Route 36 approaches at five of the six intersections (excluding the Broad Street location) currently operate under conditions where traffic demand is less than intersection capacity. At those intersections, the additional volume generated by the project would not significantly increase delays. The Broad Street intersection in Keyport presently operates at or near capacity in the westbound direction (AM peak hour) and in the eastbound direction (PM peak hour) in the eastbound direction on typical summer weekdays.

The traffic expected to be generated by existing approved planned development projects (100 vehicles) and the Fort Hancock Rehabilitation project is expected to result in a further increase in congestion at only one location, that is, along the eastbound approach of Route 36 at Broad Street during the PM peak hour. Even without the Fort Hancock project, the intersection is expected to operate poorly in the future.

The Fort Hancock Rehabilitation is expected to increase volume along the Route 36 eastbound approach at Broad Street by 80 eastbound vehicles during the PM peak hour on a typical summer weekday. This volume represents a small proportion, only 2.5 percent, of the total Build Condition traffic (about 3000 vehicles) anticipated at this

location. Application of transit and ferry service would not generate enough diversion to reduce the 80 trips for the purposes of this study.

The available green time provided by the traffic signal at Broad Street is fully utilized along each intersection approach and retiming would not improve the condition. Further, the application of enhanced transit and ferry service would likely not generate enough diversion to reduce the 80 trips for the purposes of this study because of the dispersed development patterns throughout the region.

Mitigation could be accomplished by increasing the approach width of one of the side streets at Broad Street. However, as stated above, the Fort Hancock rehabilitation is not the only potential contributor to the traffic problem at Broad Street. Existing approved planned development projects, along Route 36 and closer to Broad Street, will potentially generate a greater impact on Broad Street than the Fort Hancock development because of their larger contribution of traffic and the remoteness of the Fort Hancock site (17 miles) to the affected intersection.

Bridge Impacts

Should a new movable bridge be constructed over the Shrewsbury River, traffic waiting at the bridge would experience some increase in delay. Average vehicle delay on a bascule bridge with a 55-foot vertical clearance would increase by about 20 seconds. If the existing bridge is replaced with a fixed bridge, the current NJDOT plan, then no additional delays to traffic would be expected at the bridge site.

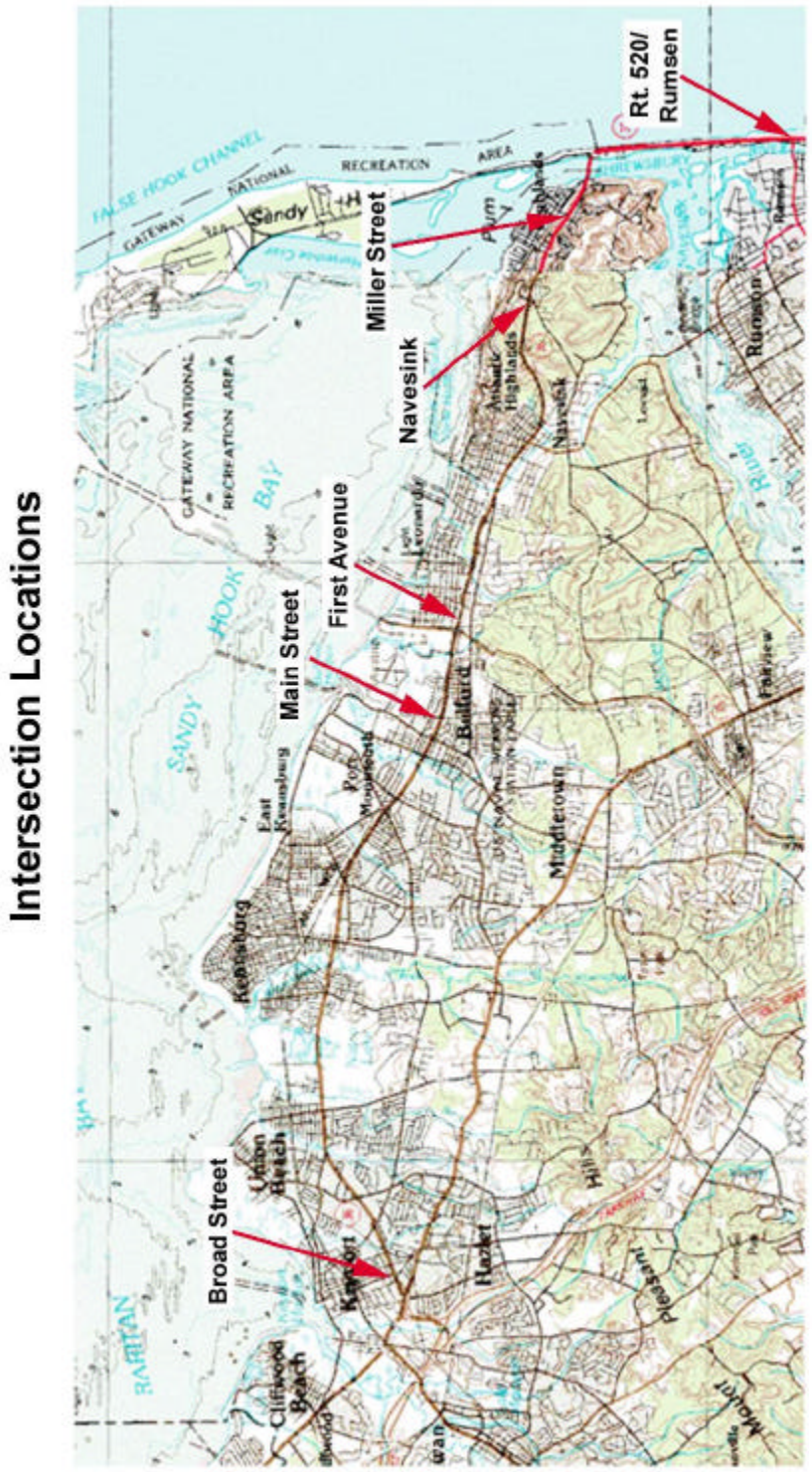


Figure 1-1 Intersection Location Map

1. Introduction

1.1. Purpose of this Traffic Study

In February of 2002, the National Park Service (NPS) issued an Environmental Assessment evaluating potential impacts resulting from the Gateway Village Rehabilitation Project. This project will be an Adaptive Use of Fort Hancock and the Sandy Hook Proving Ground (Appendix A). The report's traffic analysis estimating the project's effect on traffic operations in the area raised several questions. The Eastern Federal Lands (EFL), a branch of the Federal Highway Administration (FHWA), performed a supplemental traffic assessment, which expanded upon the EA's traffic section. Public comment on the supplemental assessment identified two areas of concern:

- The area examined was only in the immediate vicinity of the Sandy Hook Recreation Area; and
- The assessment only examined one future condition with a new 65-foot bridge, rather than an array of possible future scenarios for bridge construction.

The purpose of this study is to advance the previous traffic analyses by

- collecting a comprehensive set of primary traffic data,
- expanding the impact area to ensure a complete assessment of project impacts,
- evaluating the use of area transit opportunities to amend potential project generated congestion, and
- evaluating possible bridge build/no-build scenarios

In particular, the study estimated the potential impacts on traffic service along the Route 36 corridor resulting from the rehabilitation of Fort Hancock, and the effectiveness of mitigation strategies that could be used to reduce travel demand. Four (4) future scenarios were evaluated including a Fort Hancock No-Build, and three Fort Hancock build scenarios. The first build scenario included expanded bus service, the second assumed new ferry services to the Sandy Hook Park. The third build scenario studied the effects of additional Monmouth County planned development projects on operation of the Highlands Bridge over the Shrewsbury River. The bridge evaluation studied and compared the impacts incurred on moveable bridges with different clearances, and a fixed bridge.

1.2. Proposed Action

The Proposed Action (labeled the Rehabilitation Alternative) is the implementation of the "Fort Hancock Gateway Village" concept plan approved in National Park

Service's (NPS) 1979 General Management Plan/FEIS. The action is considered an adaptive use concept that permits historic leasing as a method to implement the rehabilitation proposal. One hundred structures have been or would be rehabilitated and reused within the Fort Hancock area. The rehabilitation site would be called the Fort Hancock Gateway Village (See Figures 1-1 and 1-2 Development Maps). Several vacant buildings (which were formerly used for residential housing) would be converted to educational, office and hospitality uses. The specific development plan is described in Appendix A.

Additional parking in Sandy Hook Park's Fort Hancock area would be required to support the rehabilitation effort. Fort Hancock's current supply of 708 parking spaces would have to be increased by approximately 665 spaces in order to accommodate the volume associated with the proposed new uses. The additional parking supply would be gained by redesigning and expanding six existing parking lots and by constructing six new lots on six acres of previously disturbed land.

A physical inventory conducted in 1999 counted 4218 spaces at beach and bayside development areas. In addition, 708 spaces at Fort Hancock are available at the park. The total number of parking spaces at Sandy Hook Park is 4926 spaces (4218 +708). The proposed adaptive use program would approximately maintain the 1999 parking supply.

This study estimates the potential impact to traffic service along Route 36 resulting from the Fort Hancock rehabilitation project, and the effectiveness of mitigation strategies to reduce travel demand and project-generated congestion. Fixed and movable bridge structures and bus and ferry operations are among the variables used to construct each set of future conditions.

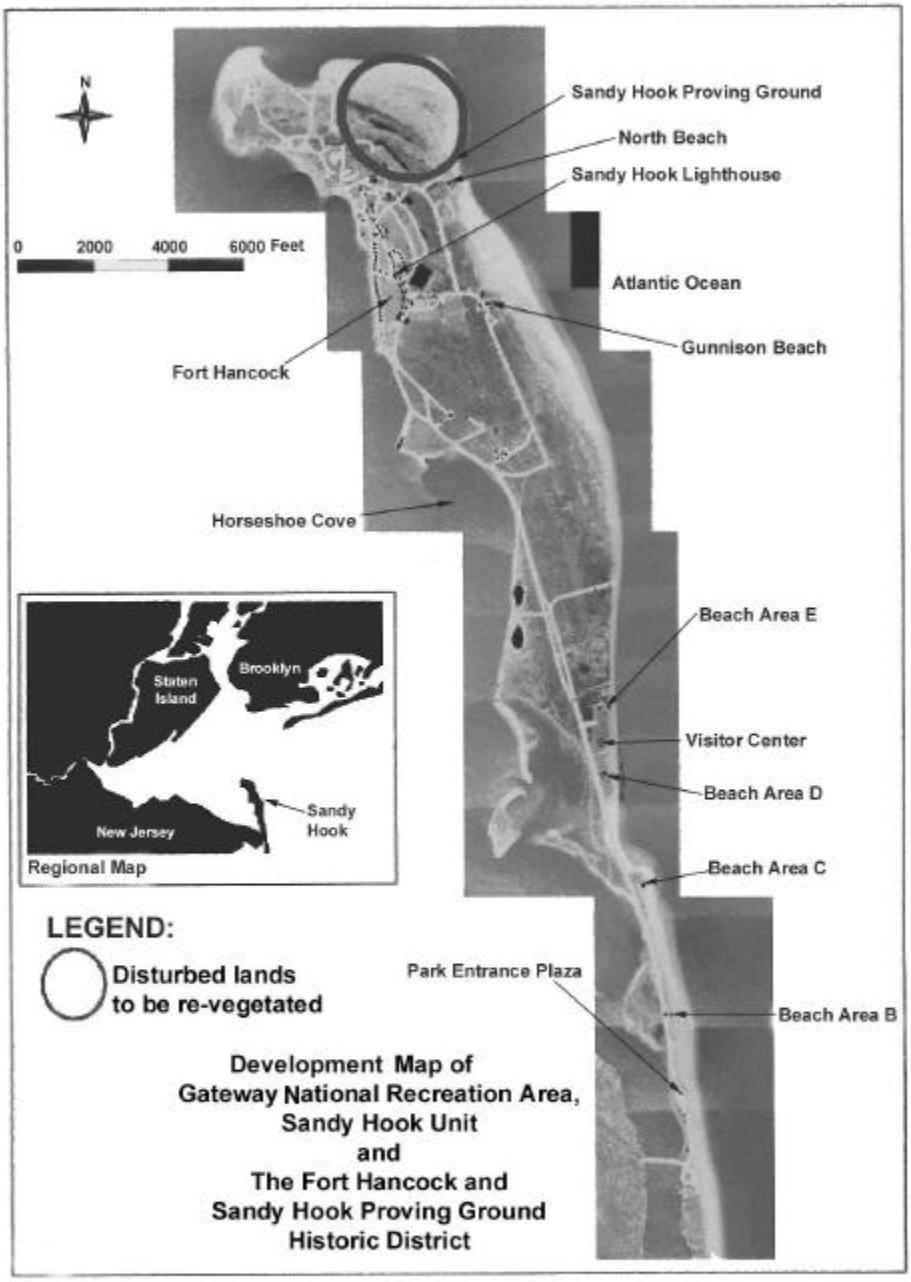


Figure 1-2 Development Map, Gateway National Recreation Area

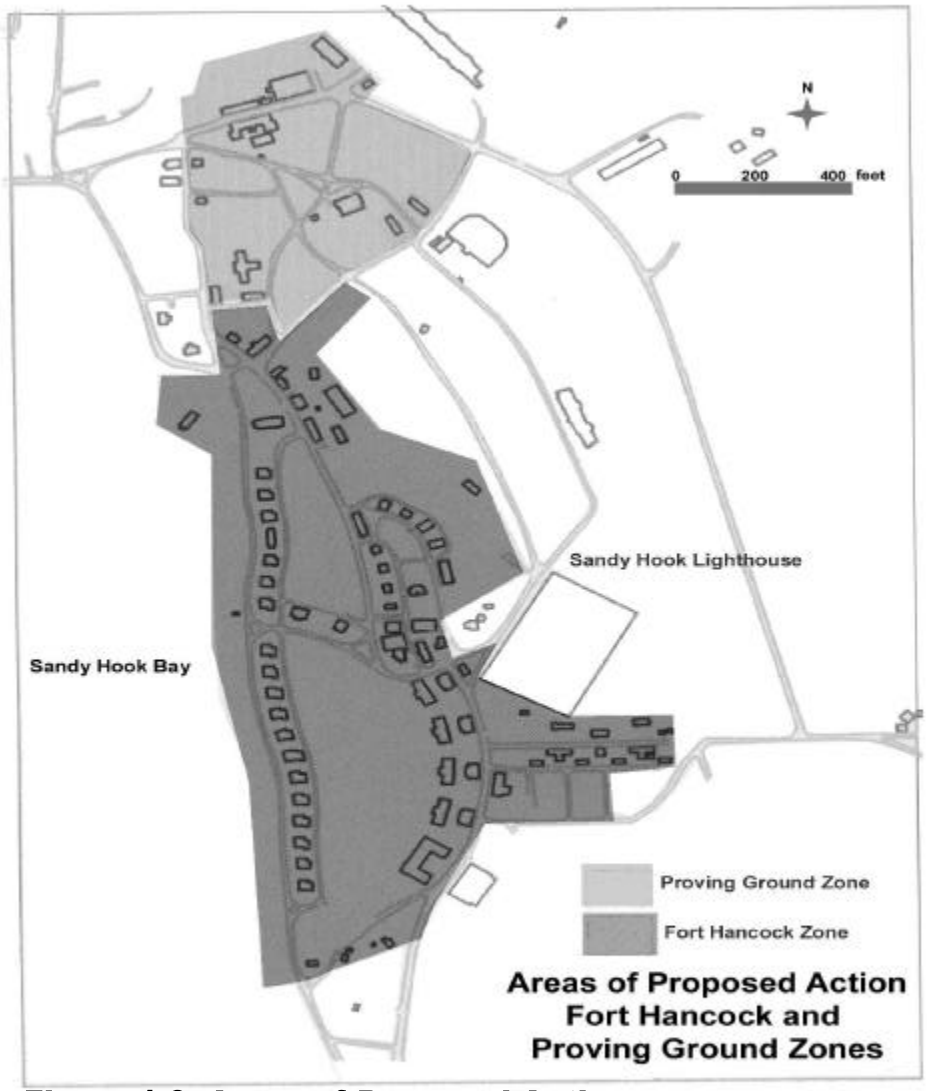


Figure 1-3 Areas of Proposed Action

2. Background

2.1. Regional Context and Local Significance

Sandy Hook Park is located in Monmouth County New Jersey in the eastern corner of the State and lies at the northern end of the State's barrier island system (See Figure 2-1). The Park is a peninsula, approximately 1700 acres in size, extending north from coastal New Jersey at Sea Bright into the convergence of Raritan Bay, Sandy Hook Bay, Lower New York Bay, and the Atlantic Ocean.

The major link connecting Sandy Hook Park with the regional highway network is Route 36. Route 36 provides the major access route to the Park from the north, west, and from the south. It is expected that most of the project-generated traffic would approach and leave the study area via Route 36. The highway meanders along a portion of New Jersey's northeast shoreline between Long Branch to the south and Keyport to the north. It provides several coastal communities with access to the Garden State Parkway (GSP). At its northern and southern termini, Route 36 connects with the GSP's Exits 117 and 105, respectively.

Route 36's alignment includes the Route 36 Bascule Bridge over Shrewsbury River, which provides a vital link across the Shrewsbury River for recreational/residential/Commercial development located on the peninsula between Monmouth Beach and Sandy Hook Park. On the mainland (Highlands), the highway is also called Navesink Avenue and generally maintains an east-west alignment. On the peninsula, the Route 36 alignment changes to a north-south orientation, and is called Ocean Avenue. About two miles south of the Route 36 Highlands Bridge, Route 36 (Ocean Avenue) connects with County Road 520 and the Sea Bright-Rumson Bridge. The entire Route 36 corridor is part of the planned evacuation route for the town of Sea Bright located on the peninsula, as stated in the municipality's Emergency Management Plan.

In the event of a medical emergency, residents in Highlands are driven by ambulance to the Monmouth Medical Center at 300 Second Avenue in Long Branch via Route 36 East across the river and Ocean Avenue south. The distance between the Route 36 Highlands Bridge over Shrewsbury River and the Monmouth County Medical Center is approximately 9 miles. If the Route 36 Highlands Bridge is closed, the alternate route requires traveling southwest using local streets to access the Oceanic Bridge, which leads into the Town of Rumson along County Road 520. The alternate route continues through Rumson, across the Sea-Bright Rumson Bridge and onto Ocean Avenue, and terminates at the Hospital, adding three miles and approximately ten minutes to the trip.

Project Area Location Map

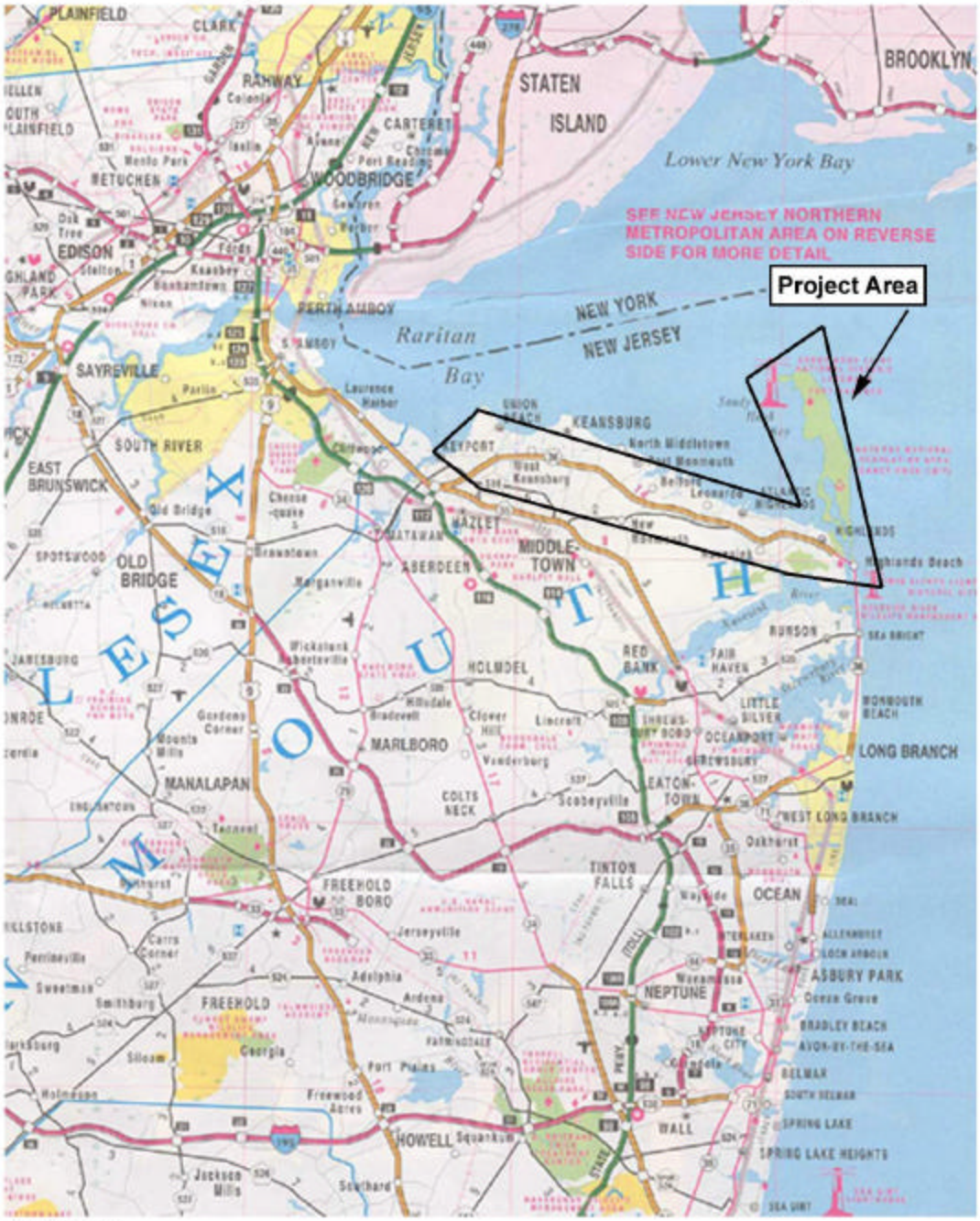


Figure 2-1

2.2. Route 36 Corridor

Six intersections along Route 36 and the Route 36 Bridge over Shrewsbury River were selected as the key locations to estimate potential traffic impacts generated by the project. The intersections include:

1. Broad Street in Keyport
2. Main Street in Middletown
3. First Avenue in Atlantic Highlands
4. Navesink Avenue in Highlands
5. Miller Street in Highlands
6. Route 520 in Sea Bright

Broad Street in Keyport was selected because it is an integral part of an important north-south corridor and is the first intersection east of the Garden State Parkway. A portion of the GSP traffic is funneled directly into the intersection without dissipation at other cross streets.

Main Street in Belford is another major north-south collector road that intersects the east-west corridors, Route 36, County Road 516, and Route 35. It is located about seven miles east of Broad Street. At the northern end of Main Street, a new commuter ferry service between Monmouth County and New York City has been initiated. Ferry operations began on October 28, 2002. The operator is New York Waterways (See Appendix B for ferry schedule). Free Customer parking is available in off-street parking lots.

First Avenue is a north-south collector road in Atlantic Highlands. At the northern end of First Avenue, commuter ferry service between Monmouth County and New York City is available. Ferry operations began several years ago, and are operated by New York Fast Ferry and Sea Streak (See Appendix B for ferry schedule). Free Customer parking is available.

Navesink Avenue is a major collector with traffic sources in southeast Middletown. Together with its connection to Locust Avenue and the Oceanic Bridge, Navesink Avenue also can connect to Red Bank and Sea Bright. Navesink Avenue forms a corridor that, together with Swamp Nut Road and Dwight Road, connects the GSP at Exit 114 with Route 36 in Highlands.

Miller Street is the easternmost signalized intersection on Route 36, before crossing the Shrewsbury River. The study of this intersection will provide insight into the potential impact of project-generated traffic on queuing conditions near the Bridge under future scenarios that assume a bascule bridge will be in operation.

Route 520 intersects Route 36 at the point where the Sea Bright Rumson Bridge crosses the Shrewsbury River in Sea Bright. This location provides motorists with a second, southern crossing opportunity over the river to access Sea Bright and Sandy Hook Park.

The Route 36 Bridge maintains two travel lanes in each direction. Each travel lane is eleven (11) feet wide. The posted speed limit across the bridge is 45 mph. An exit ramp (Ramp L), located at the eastern terminus of the Bridge, provides access to Sandy Hook Park. Ramp J provide vehicles leaving the Park with direct access onto Route 36 Bridge westbound. Vehicles from the south can travel directly into the park via Ocean Avenue, a one-way connection from Sea Bright to the toll plaza area at the Park

Internal conditions in the Park were not examined quantitatively. The existing Hartshorne Drive, with its two lanes in each direction, has a capacity of 3800 vehicles per hour in each direction. The parking capacity in Sandy Hook Park, about 5000 spaces, limits travel demand on Hartshorne Drive from reaching capacity since this artery only services the Park. Parking management activities conducted in the Park, and signage along approach routes to the Park providing information on parking availability also assist in improving traffic flow along Hartshorne Drive.

3. Existing Conditions

3.1. Highway Classifications

The sections of Route 36 under investigation are classified functionally as Urban Principal Arterial.

3.2. Posted Travel Speeds

The field surveys conducted on October 23 and October 31, 2002 showed that the posted speed limit near the study area intersections along Route 36 varies generally between 45 and 50 miles per hour (mph) on the mainland, and between 35 and 45 mph on the peninsula.

3.3. Geometry

3.3.1. Broad Street/Route 36

Route 36 forms the east and west legs of this intersection and maintains two 12 ft.-wide travel lanes and one 14 ft.-wide travel lane in each direction (See Appendix C, Intersection Geometry). Left turns are not permitted in either direction. Parking in the curb lane is also not permitted along the eastbound and westbound approaches. Curb cuts are available along the eastbound and westbound approaches to access a bank and a gasoline station.

Broad Street forms the north and south legs of the intersection. Both the northbound and southbound approaches maintain two travel lanes, including an exclusive left-turn lane and a lane from which thru and right turn movements are permitted. The travel lanes are each 12 ft. wide except for the southbound left-turn lane, which is 13 ft. wide. On-street parking is not permitted on either approach.

Traffic flow through the intersection is controlled by a two-phase actuated signal. The cycle length is 120 seconds during the peak hours between May and September (See Appendix D, Signal Timing Plans). A pedestrian button is available to actuate a walk phase.

3.3.2. Main Street/Route 36 (Belford)

Route 36's eastbound approach provides for three 12 ft.-wide travel lanes. No turns are permitted in the eastbound direction (See Appendix C). Left-turn maneuvers from Route 36 to Main Street northbound can be made from Route 36 by using a cup handle on the far side of the intersection. The bi-directional traffic along Route 36 is separated by a Jersey barrier.

Two 12 ft.-wide lanes are available along Route 36 in the westbound direction. Left-turns are not permitted along this approach. A service station is located in the northwest quadrant of the intersection.

Main Street maintains two 12-ft. travel lanes in each direction, including an exclusive left-turn lane and a thru/right-turn lane.

Traffic flow through the intersection is controlled by a three-phase actuated signal. The cycle length is 120 seconds during the summer season. A pedestrian button is available to actuate a walk phase.

3.3.3. First Avenue/Route 36

Route 36 maintains three travel lanes in each direction including two 12-ft. wide lanes and one 13-ft. wide lane. Left-turns are not permitted in either direction at the intersection (See Appendix C). In the eastbound direction, a far-sided "cup handle" is available which permits eastbound to northbound movement at this location. Right-turn on red is not permitted in the westbound direction. Curb cuts are located along both approaches to provide access for an auto center business and a bank. A bus stop is located in the intersection's southeast quadrant.

First Avenue's northbound and southbound approaches each maintain an exclusive left-turn lane and a thru/right-turn lane. Each lane is 12 ft. wide.

Traffic flow is controlled by a three-phase actuated signal with separate phases provided for the northbound approach and southbound approach. The cycle length is 120 seconds between 7 AM and 7 PM during the summer season. A pedestrian button is also available to actuate a walk phase across the street.

3.3.4. Navesink Avenue/Route 36

Route 36 maintains two twelve-ft. wide travel lanes and a 10-ft. wide shoulder in each direction (See Appendix C). No turns are permitted in the eastbound direction; left-turns are not permitted in the westbound direction. A channelized lane for right-turn moves is available along the eastbound approach. Vehicles using this lane are not controlled by the intersection's traffic signal.

Navesink Avenue provides two 11-foot wide lanes and two 12-foot wide lanes in the northbound and southbound directions, respectively. Along the northbound approach, a channelized lane for right-turn moves is provided.

Traffic flow is controlled by a two-phase actuated signal with a pedestrian button. The cycle length is 120 seconds.

3.3.5. Miller Street/Route 36

Route 36 maintains two 11 ft.-wide lanes and a 7 ft.-wide shoulder in the eastbound direction, and an 11 ft. lane and a 24 ft.-lane in the west bound direction (See Appendix C). The intersection is characterized by two T-intersections that are offset by 110 feet. The T-intersection formed between eastbound Rt. 36 and Miller Street does not permit U-turns, or turns on red. Similarly, the T-intersection between west bound Rt. 36 and Miller Street does not permit U-turns, or turns on red. Left turns from eastbound Route 36 onto northbound Miller Street are permitted at the intersection. Left turns along Route 36 westbound are not permitted at the intersection. A bus stop for the Long Branch NJ Transit line is located in the southwest quadrant of the Rt. 36/Miller Street intersection.

The south leg of Miller Street is 28 feet wide and maintains one lane in each direction. Miller Street's north leg is 24 feet wide and also carries bi-directional traffic. No turns on red are permitted at either T-intersection. A curb cut into a church parking lot is located in the southwest quadrant of the Route 36 eastbound Miller Street intersection.

Traffic flow through the T-intersections is controlled by a two-phase actuated signal. The cycle length is 120 seconds during the summer season.

3.3.6. County Route 520/Route 36

Route 36 connects with County Route 520 via a T-intersection. Route 36 is also known as Ocean Ave in Sea Bright (See Appendix C). Southbound traffic is divided into two 12 ft.-wide lanes, with the outside lane channeling right-turn movements onto County Route 520, and the inside lane continuing southbound. A curb cut along the southbound approach provides access to an apartment building. Northbound traffic is divided into two 12 ft.-wide lanes. The inside lane is designated exclusively for left-turns and the outside lane for through traffic.

Approaching from the west on the Rumson Bridge, County Route 520 provides two 10 ft.-wide lanes in the eastbound direction, one for left-turns only and the other for right-turns only.

Traffic flow is controlled by a three-phase actuated signal with separate phases provided for each approach. The first phase allows traffic to move in the north-south direction. The second phase allows the northbound left-turning traffic to move and eastbound right-turning traffic to move. The third phase permits County Route 520 traffic to move. The cycle length is 90 seconds (See Appendix D). A pedestrian button is also available to actuate a walk phase across the street.

3.3.7. Route 36 Bridge

Opened to traffic in 1933, the Route 36 Highlands Bridge is a four-lane structure consisting of eleven simple fixed spans and one double leaf bascule span. Eight-ft. wide sidewalks are also provided. Each lane is eleven feet wide, which is less than a standard lane width of 12 ft. No shoulders are provided on the Bridge.

The length of the Bridge is 1240 ft. The first three spans from the west and the last six spans are concrete-encased, three-girder spans. The flanking spans on either side of the movable span are un-encased, two-girder spans. The flanking spans are a three-girder system and the bascule span is a two-girder system, arranged in a configuration that could result in the collapse of the Bridge if any one girder would collapse. The roadway surface is a concrete deck on the approach and flanking spans and an open steel grating on the bascule span. Both approaches to the Bridge have curved alignments that extend onto the structure. The west approach curves across the first three spans ending at the centerline of Pier 3. The east approach curves at the centerline of Pier 10 and extends across Spans 11 and 12. The remainder of the Bridge is on tangent alignment (See Appendix E, Route 36 Highlands Bridge Over Shrewsbury River).

The Bridge is functionally obsolete. Equipment on the bridge is not reliable, and the bridge is scheduled for replacement. The bridge is currently rated in poor condition with a sufficiency rating of 34.3 out of 100. The bridge is substandard structurally and geometrically as evidenced by its low structural rating, higher than normal accident rates and severe operational conflicts between vehicular and marine traffic. Vertical clearance is 35 feet when the bascule span is closed. Although a 55-foot vertical clearance movable bridge alternative has been examined, it is likely that the bridge will be replaced with a fixed structure. The new vertical clearance will be 65 feet, based on preliminary discussions with the Coast Guard.

The street network surrounding the Route 36 Bridge includes portions of three corridors, namely, Navesink Avenue, Ocean Avenue, and Hartshorne Drive in Sandy Hook Park. (Route 36 is called Navesink Avenue on the west side of the bridge and Ocean Avenue on the east side of the bridge.) These corridors form a T-connection at the eastern terminus of the bridge, with Navesink entering the span from the west and Ocean Avenue and Hartshorne Drive entering the span from the southeast and northeast, respectively.

West of the Highlands Bridge, Route 36 is an east-west, four-lane divided highway that serves an important regional function by providing direct access into Sandy Hook Park from the mainland. Route 36 also provides the most direct access to the Jersey Shore from the north, at least down to Monmouth Beach. Local streets that feed traffic onto Route 36 at the western terminus of the bridge include Bay Avenue, Portland Road, and Highland Avenue. These thoroughfares are each two-lane roads. On the east side of the bridge, Ocean Avenue extends

south along the peninsula to the town of Long Branch while Harthshorne Drive connects with Sandy Hook (See Appendix E).

3.4. Traffic Volumes

Traffic volume data were collected along Route 36 between November 6 (Wednesday) and November 18, 2002. The data included both automatic traffic recorders and manual-turning movement counts (See Appendix F, November 2002 Turning Movement/ATC Counts). According to traffic data collected by the New Jersey Department of Transportation (NJDOT), the heaviest traffic flows along the corridor occur in July. Sandy Hook Park data collected at the toll plaza show that the heaviest park usage also occurs in July (See Appendix I, Sandy Hook Park, Toll Plaza Volumes). The November (off-season) counts were seasonally adjusted to July volume levels in order to present a "worst case summer condition" analysis. The volume adjustment was performed by using a combination of data from an NJDOT permanent count station (Station # 6-1-20) along Route 36 in Sea Bright, and ATR data collected near the Route 36 Bridge in August/September 2001 (Route 36 Bridge over the Shrewsbury River Feasibility Assessment Report, August/September 2001).

The 12 months of data collected at the Sea Bright permanent count station are presented in Appendix G, NJDOT Permanent Count Stations Sea Bright, NJ, Seasonal Adjustment Factors along with the estimations of November and July seasonal factors for weekday and weekend periods. The estimations were also made separately for each direction. November volumes were adjusted to represent July volumes by multiplying the 2002 November volumes by a seasonal adjustment factor (See Appendix G).

3.4.1. AM Peak Hour (7:30 AM – 8:30 AM) (July)

Weekday Conditions

The peak hour was determined based upon traffic movements with respect to the Garden State Parkway. Eastbound traffic travels from the GSP to Sea Bright Boro, and westbound traffic travels from Sea Bright to the GSP. The peak travel direction is westbound toward the GSP during the AM peak hour. Traffic flows are lowest crossing the Bridge, about 600 vehicles per hour (vph), but gradually increase to over 2700 vph at Broad Street near the GSP (See Figure 3-1). In the eastbound direction, the opposite trend occurs as volumes gradually dissipate between the GSP and the Route 36 Bridge from almost 1400 vph to about 550 vph at the river crossing.

Local street volumes range between 100 vph and 800 vph in the southbound direction and between 90 vph and 900 vph in the northbound direction. The highest total cross street volumes occur at First Avenue. A portion of this traffic is

destined for the New York Fast Ferry and Sea Streak America, Inc. ferry services, which are both located on First Avenue. These ferry operations offer service between Atlantic Highlands and Manhattan.

3.4.2. PM Peak Hour (4:45 – 5:45 PM) (July)

Weekday Conditions

The peak travel direction in the PM peak hour is generally eastbound, or the reverse of the AM peak hour. In the eastbound direction, volumes range between 2700 vph at Broad Street 600 vph at Miller Street (See Figure 3-2). In the westbound direction, traffic demand varies between 500 vph at Miller Street and almost 1600 vph at Broad Street.

The highest cross street volume occurs at First Avenue in the southbound direction where about 1000 vph were counted. Along the southbound approaches of the other cross streets, volumes range between 100 vph at Miller Street and 500 vph at Navesink Avenue. In the northbound direction, volumes vary between 100 vph at Miller Street and 700 vph at First Avenue.

Weekend Conditions

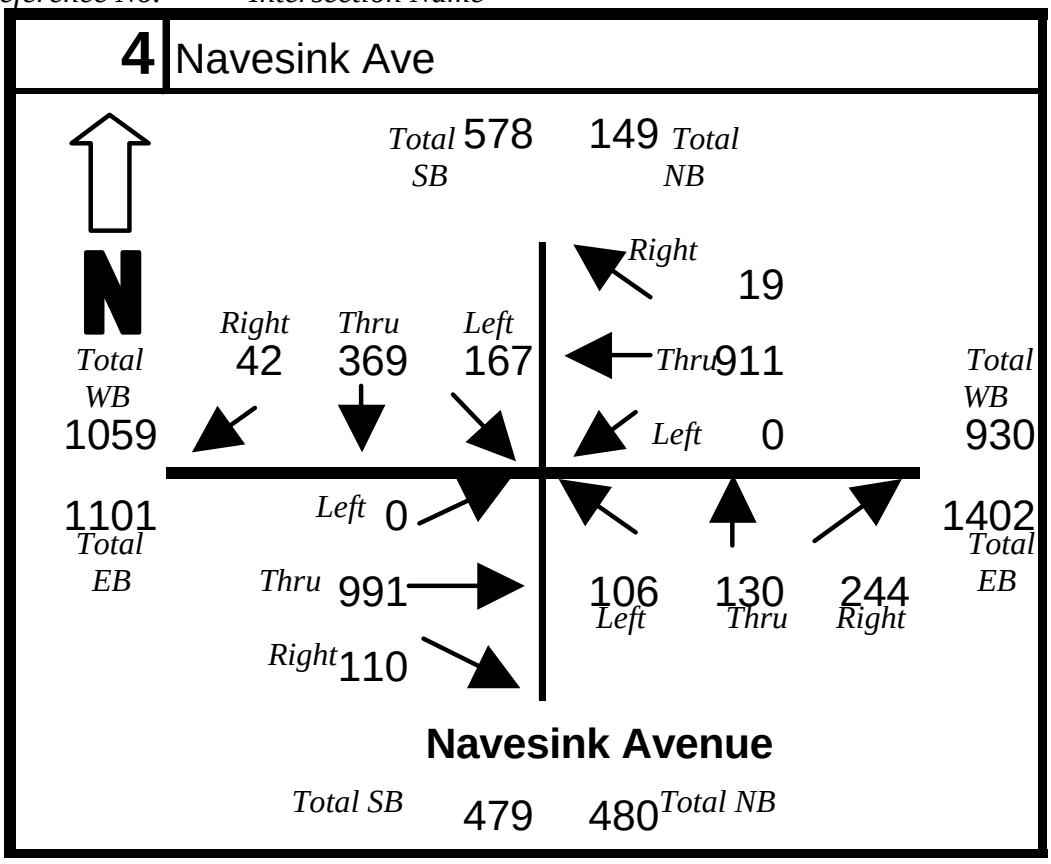
The Institute of Traffic Engineers Trip Generation Handbook, sixth edition, provides data for one peak hour generator for Saturday. The field data shows that the highest traffic flows in the study area generally occurred between 4:45 and 5:45 PM. Therefore, the 4:45-5:45 PM hour was selected as the weekend study period to estimate potential project impacts on the roadway network.

In the eastbound direction, volumes range between 2300 vph at Broad Street and 650 vph at Miller Street (See Figure 3-3). Volumes are lower in the westbound direction where the highest volume, about 2000 vph, occurs at Broad Street.

The highest cross street volumes are found along the southbound approach of First Avenue (about 1050 vph) and along the northbound approach of First Avenue (about 650 vph).

Key to Intersection Volume Diagrams

Intersection Reference No. *Intersection Name*



Notes:

1. *Interpretive notes appear as italic font.*
2. *Each arrow represents a left, right, or through move from an approach of the intersection.*
3. *North Arrow indicates Northerly Direction. For this example, North is up.*
4. *Total volumes (left + thru + right) appear at the edges of the box.*
5. *Cross Street Label is shown inside the box.*
6. *Intersection reference number and name are shown in separate boxes at the top.*

Traffic Impact Study

National Parks Service

AM Existing Summer Weekday

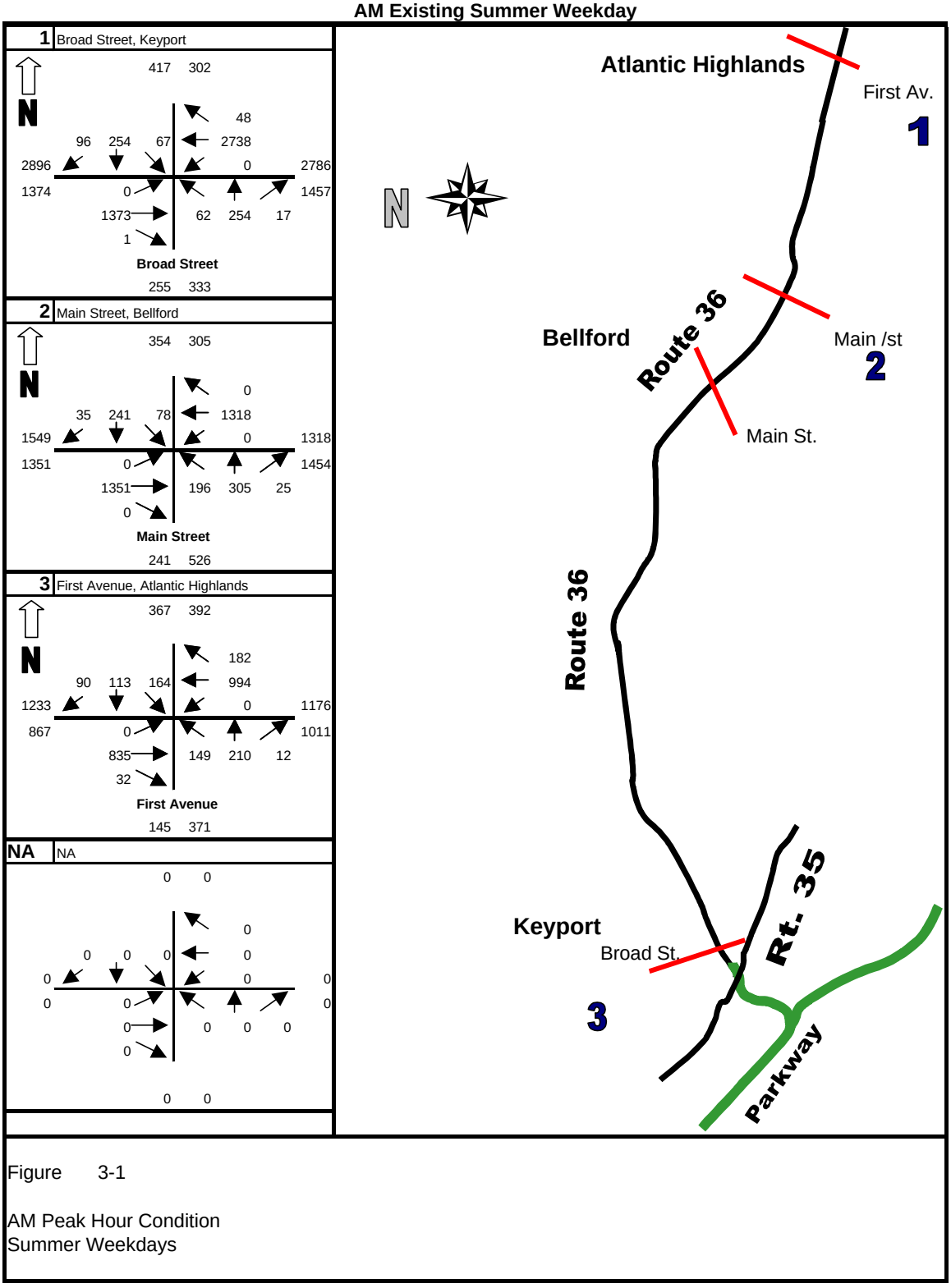


Figure 3-1

AM Peak Hour Condition
Summer Weekdays

AM Existing Summer Weekday

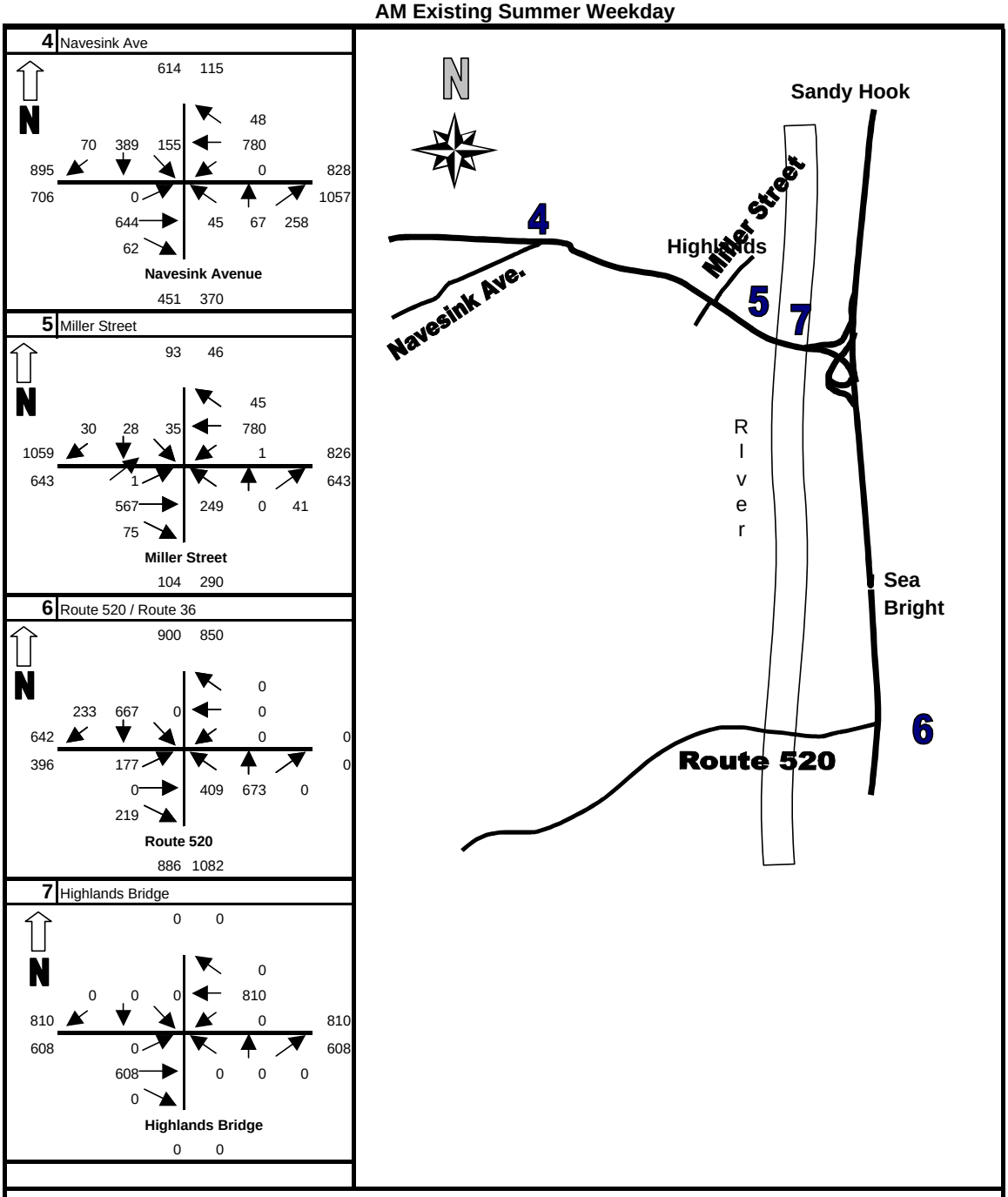


Figure 3-1 continued

AM Peak Hour Condition
Summer Weekdays

PM Existing Summer Weekday

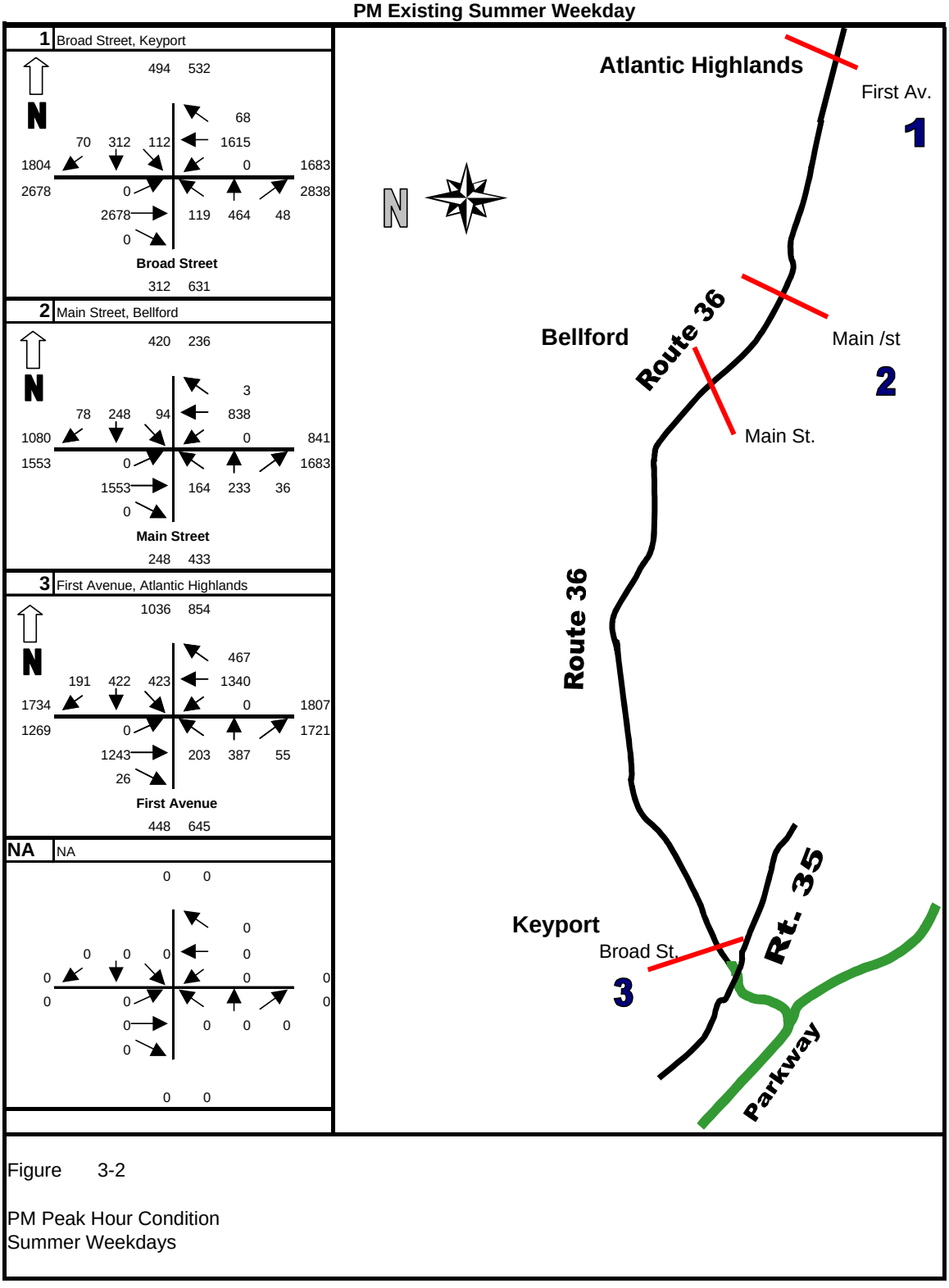


Figure 3-2

PM Peak Hour Condition
Summer Weekdays

PM Existing Summer Weekday

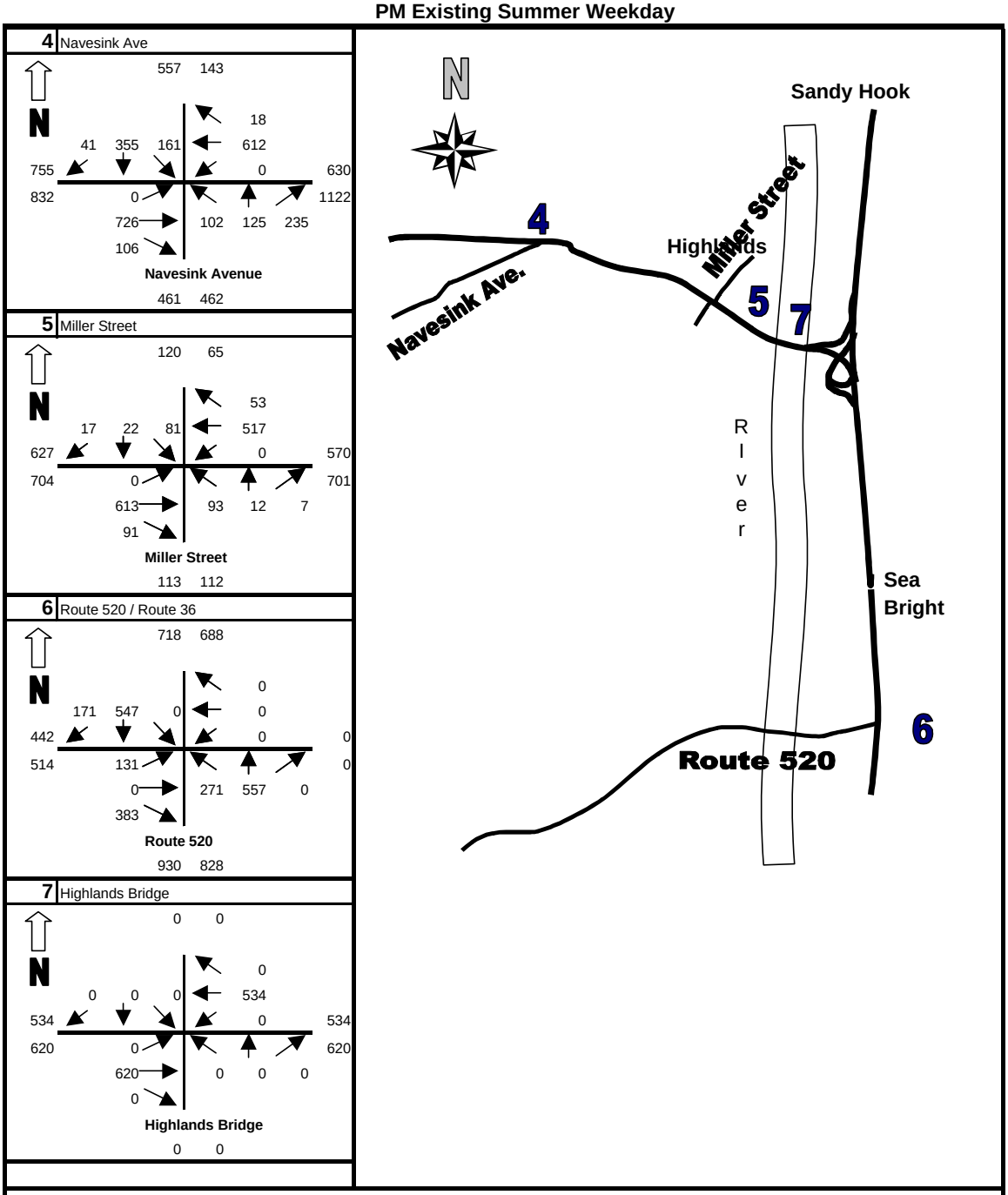


Figure 3-2 Continued

PM Peak Hour Condition
Summer Weekdays

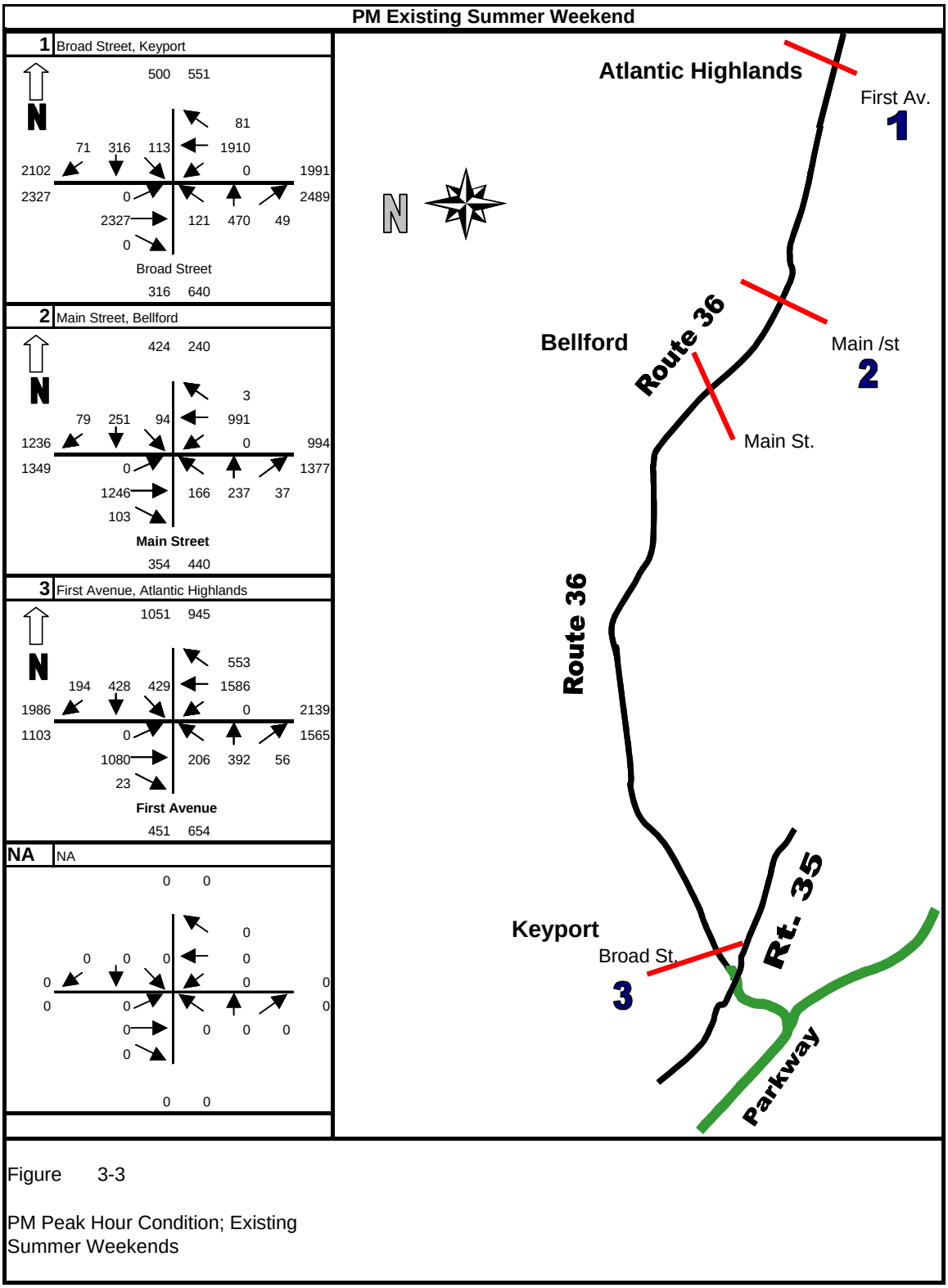


Figure 3-3

PM Peak Hour Condition; Existing
Summer Weekends

PM Existing Summer Weekend

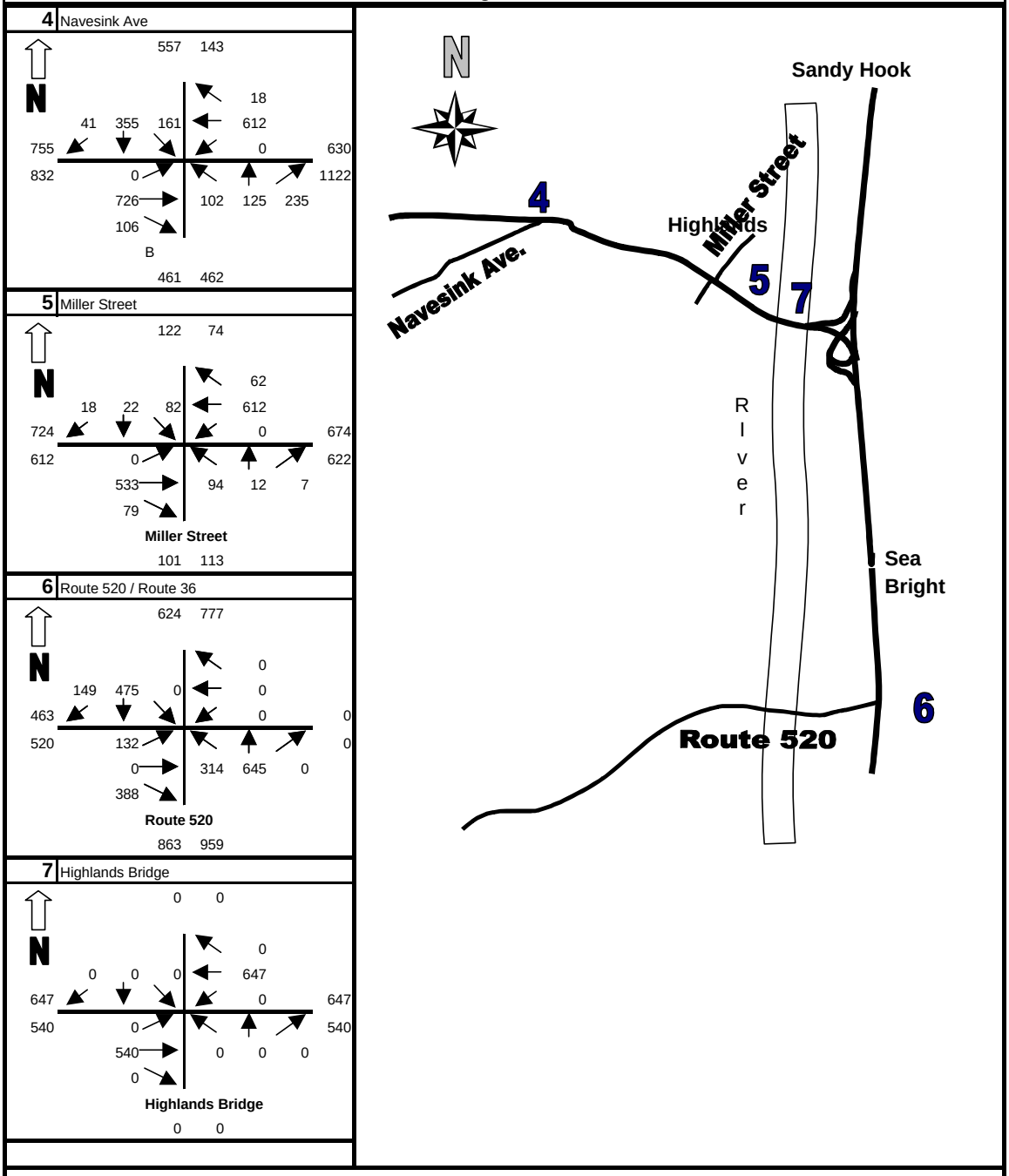


Figure 3-3 continued

PM Peak Hour Condition, Existing
Summer Weekdends

3.5. Levels of Service (LOS)

The operating conditions of transportation facilities are evaluated based on the relationship of existing and projected volumes to the theoretical capacity of the facility. Various factors affect capacity, including traffic volume, speed, roadway geometry, grade, and traffic control. The current standards for evaluating capacity and operating conditions are published in the *Highway Capacity Manual 2000*. These procedures describe operating conditions in terms of LOS, designated by the letters "A" for unrestricted free-flow operating conditions, through "F", representing congested operations. LOS for intersections is based on the average delay per vehicle in seconds. The ranges of delay that correspond to a particular LOS are presented below.

LOS	Delay (seconds)
A	0 and 5
B	>5 and 15
C	>15 and 25
D	>25 and 40
E	> 40 and 60
F	> 60.

Each approach (north, south, east, west) is evaluated for delay and LOS. LOS's were determined for the six representative study intersections under different operating conditions. Tables 3-1 through 3-3 illustrate the results of these determinations. Details of the analyses are discussed below.

3.5.1. Weekday Conditions

AM Peak Hour

Traffic operates at LOS D or better along Route 36 in both directions (See Table 3-1) NJDOT considers LOS D or better as an acceptable LOS. The highest congestion levels generally occur along the left-turn lanes of the local streets where almost all movements operate at LOS D or worse.

PM Peak Hour

In general, traffic operates at LOS D or better along Route 36 eastbound (Table 3-2). In the westbound direction, traffic operates at LOS C or better. Traffic operations on the local streets are more congested. Traffic along several approaches including the northbound and southbound approaches at Broad

Street, at Main Street, and at First Avenue operate near or at capacity (See Table 3-2). Congested conditions are also experienced along left-turn lanes along the southbound approach of Navesink Avenue and the northbound approach of Route 36 at Route 520.

3.5.2. Weekend Conditions

Conditions are more congested along the cross streets where LOS D or worse is experienced. The highest delays are found along Broad Street, Main Street, and First Avenue where LOS F conditions occur in the peak hour (See Table 3-3).

TABLE 3-1
EXISTING TRAFFIC OPERATIONS
WEEKDAY
AM PEAK HOUR

Intersection		V/C Ratio	Delay in Seconds	LOS
Broad St./Route 36				
NB	LT	0.55	51	D
	Thru/RT	0.48	37	D
SB				
	LT	0.32	36	D
	Thru/RT	0.76	48	D
EB				
	Thru/RT	0.46	14	B
WB				
	Thru/RT	0.94	30	C

Intersection		V/C Ratio	Delay in Seconds	LOS
First Ave/Route 36				
NB	LT	0.49	47	D
	Thru/RT	0.69	55	D
SB				
	LT	0.62	55	D
	Thru/RT	0.77	64	E
EB				
	Thru/RT	0.36	19	B
WB				
	Thru/RT	0.5	21	C

Intersection		V/C Ratio	Delay in Seconds	LOS
Miller Street/Route 36				
NB	LT/RT	1	91	F
SB	Thru/RT	0.26	35	D
EB	LTR	0.33	11	B
WB	Thru/RT	0.4	11	B

Main Street/Route 36				
NB	LT	1.04	122	F
	Thru/RT	0.71	46	D
SB				
	LT	0.41	54	D
	Thru/RT	0.6	42	D
EB				
	Thru	0.63	26	C
WB				
	Thru	0.88	37	D
	Thru/RT			

Navesink Ave./Rt.36				
NB	LT	0.84	114	F
	Thru/RT	0.14	31	C
SB				
	LT	0.46	38	D
	Thru/RT	0.98	75	E
EB				
	Thru	0.33	13	B
WB				
	Thru/RT	0.4	14	B

Route 520/Route 36				
NB	LT	1.43	247	F
	Thru	0.87	34	C
SB				
	Thru	0.86	33	C
	RT	0.23	6	A
EB				
	LT	0.76	53	D
	RT	0.44	22	C

Notes: V/C Ratio = volume to capacity ratio
LOS = level of service

TABLE 3-2
EXISTING TRAFFIC OPERATIONS
WEEKDAY
PM PEAK HOUR

Intersection		V/C Ratio	Delay in Seconds	LOS
Broad St./Route 36				
NB	LT	0.81	68	E
	Thru/RT	0.95	64	E
SB				
	LT	2.1	582	R
	Thru/RT	0.72	41	D
EB				
	Thru/RT	1.02	49	D
WB				
	Thru/RT	0.71	22	C

Intersection		V/C Ratio	Delay in Seconds	LOS
First Ave/Route 36				
NB	LT	0.67	54	D
	Thru/RT	1.41	246	F
SB				
	LT	1.59	330	F
	Thru/RT	2.29	640	F
EB				
	Thru/RT	0.53	21	C
WB				
	Thru/RT	0.78	27	C

Intersection		V/C Ratio	Delay in Seconds	LOS
Miller Street/Route 36				
NB	LT/RT	0.38	38	D
SB	Thru/RT	0.37	38	D
EB	LTR	0.36	11	B
WB	Thru/RT	0.28	11	B

Main Street/Route 36				
NB				
	LT	0.87	85	F
	Thru/RT	0.59	41	D
SB				
	LT	0.5	57	E
	Thru/RT	0.72	47	D
EB				
	Thru	0.72	29	C
WB				
	Thru	0.56	26	C
	Thru/RT			

Navesink Ave./Rt.36				
NB				
	LT	1.22	205	F
	Thru/RT	0.83	53	D
SB				
	LT	1.44	279	F
	Thru/RT	0.84	53	D
EB				
	Thru	0.37	13	B
WB				
	Thru/RT	0.31	13	B

Route 520/Route 36				
NB				
	LT	0.95	75	E
	Thru	0.72	25	C
SB				
	Thru	0.71	25	C
	RT	0.17	5	A
EB				
	LT	0.55	42	D
	RT	0.75	31	C

Notes: V/C Ratio = volume to capacity ratio
LOS = level of service

TABLE 3-3
EXISTING TRAFFIC OPERATIONS
WEEKEND
PM PEAK HOUR

Intersection		V/C Ratio	Delay in Seconds	LOS
Broad St./Route 36				
NB	LT	1.33	240	F
	Thru/RT	1.1	109	F
SB	LT	2.11	591	F
	Thru/RT	0.83	53	D
EB	Thru/RT	0.83	23	C
WB	Thru/RT	0.7	19	B

Intersection		V/C Ratio	Delay in Seconds	LOS
First Ave/Route 36				
NB	LT	0.68	54	D
	Thru/RT	1.42	254	F
SB	LT	1.61	340	F
	Thru/RT	2.32	655	F
EB	Thru/RT	0.46	20	C
WB	Thru/RT	0.92	35	D

Intersection		V/C Ratio	Delay in Seconds	LOS
Miller Street/Route 36				
NB	LT/RT	0.38	38	D
SB	Thru/RT	0.38	38	D
EB	LTR	0.33	11	B
WB	Thru/RT	0.35	11	B

Main Street/Route 36				
NB	LT	0.87	86	F
	Thru/RT	0.6	41	D
SB	LT	0.51	57	E
	Thru/RT	0.73	47	D
EB	Thru	0.63	27	C
WB	Thru/RT	0.46	24	C

Navesink Ave./Rt.36				
NB	LT	1.29	230	F
	Thru/RT	0.84	54	D
SB	LT	1.51	309	F
	Thru/RT	0.85	54	D
EB	Thru	0.32	13	B
WB	Thru/RT	0.37	13	B

Route 520/Route 36				
NB	LT	1.1	116	F
	Thru	0.84	31	C
SB	Thru	0.62	22	C
	RT	0.15	5	A
EB	LT	0.55	42	D
	RT	0.76	32	C

Notes: V/C Ratio = volume to capacity ratio
LOS = level of service

3.6. Transit Service

3.6.1. Ferry

The area is served by three ferry operations that can be accessed via Route 36. The Sea Streak America, Inc. operates service between Midtown/Wall Street in Manhattan and Highlands and Atlantic Highlands in New Jersey. In New Jersey, the ferry docks are located at the end of First Avenue. In the inbound direction, Sea Streak America operates three ferries from Highlands between 6:20-7:55 AM and two ferries from Atlantic Highlands, 1 at 7:00 AM and the other at 8:50 AM.

The New York Fast Ferry operates between Highlands and Midtown/Wall Street in Manhattan. The docks are located at the Sandy Hook Bay Marina and the Clam Hut off Atlantic Street. In the inbound direction, ferries operate between 6:10 –11:00 AM.

NY Waterway also operates service between Belford and Midtown/Wall Street in Manhattan. The docks are located at Harbor Way. Ferries operate on 30-minute headways to Wall Street and 60-minute headways to Midtown in the inbound direction between 6:00-9:40 AM. NY Waterways also offers connecting service between Belford and Hoboken.

Each service provides a free park-and-ride lot for commuters.

3.6.2. Bus

The area is served by three NJ Transit bus lines that are operated by Academy Bus Company. The Red Bank-Monmouth Mall-Long Branch line (831) operates six days a week from 6:30 am to 6:45 pm. The buses run every half hour from 6:30 am to 8:00 am, and then run every hour on the hour. Sunday bus services is limited with one bus running every hour from 10:00 am to 6:00 pm. The bus route runs along Rt. 36 from the intersection with Rt. 35 to Ocean Port Ave in West Long Branch. Bus 831 makes a stop at the end of Oceanport Gardens in Oceanport, and at the intersection of Rt. 36, Oceanport Ave., and Broadway.

The Perth Amboy-Campbell's Junction line (817) runs weekdays and Saturdays from 5:30 am to 7:30 pm, and stops every hour on the half hour. Buses travel along Rt. 36 from Union Ave. in Union Beach, to Main St. in Belford. Bus 817 makes a stop at the intersection of Rt. 36 and Main St. in Port Monmouth, before continuing on to Campbell's junction.

The Red Bank-Highlands line (834) runs weekdays and Saturdays from 6:00 am to 8:00 pm, and stops every hour on the hour. Buses travel along Rt. 36 from

Leonard Ave. in Leonardo, to Bay Avenue in Highlands. Bus 834 makes several stops along Rt. 36, including stops at Leonard Avenue, at First Avenue in Atlantic Highlands, and at Navesink Avenue. Buses then proceed to Bay and Water Witch Avenue in Highlands.

If bus service were to be expanded in the area, traffic congestion could be reduced particularly along the Route 36 corridor. For example, one opportunity for enhanced service to Sandy Hook Park would be to modify the Red Bank-Monmouth Mall-Long Branch line (831) and extend Line 831 service into Sandy Hook Park.

3.7. Recent Activities at Fort Hancock

3.7.1. Summer Leasing Program

Until 2000, the NPS offered a variety of summer educational and recreational programs operating under the Officer's Row Summer Lease Program at Fort Hancock (See Appendix H, Officer's Row Summer Lease Program). In total, these programs were conducted in eight separate buildings that occupied a total space of approximately 17,600 square feet (SF). These programs were scheduled during the 12-week period between June and August and generated about 7,500 round trips over that period. The summer leasing program was discontinued due to safety concerns regarding buildings that did not meet fire or safety codes.

According to NPS officials, about 60 percent, or 4500 round trips, were generated on weekends. The remaining 3000 round trips occurred on weekdays. Demographic data presented in the Environmental Assessment Adaptive Use of Fort Hancock and Sandy Hook Proving Ground District, 2002 show that the commuting method, "driving alone", accounts for almost 75 percent of all commuter trips made in northern Monmouth County (See Appendix H). For purposes of presenting a conservative analysis, it was assumed that each trip destined for Fort Hancock was made in a single occupancy vehicle.

On a daily basis, the Park's Fort Hancock area generated about 50 round trips (3000/60 weekdays) on summer weekdays, and about 340 round trips (4500/12 weekends) on summer weekends. About 80 percent (support this number with FAR RT 36 ATR counts) of all Fort Hancock-generated trips were assumed to occur during the peak hours of background traffic.

3.7.2. Events

A number of weekend events, formerly held at the Park, were discontinued due to a nation wide prohibition on product sales in National Parks. These events included the:

- Clearwater Festival
- Indian Pow Wow
- Antique Auto Show
- Motorcycle Festival, and the
- Irish Festival.

During the non-summer period (September-May), activity at the Fort is minimal. If the proposed project is not implemented, the Summer Leasing program could resume at Fort Hancock with sufficient investment to ensure the safety of visitors.

3.8 Parking

Currently, there are eighteen parking areas dispersed throughout Fort Hancock. These lots contain about 15 percent (708 spaces) of the Park's total supply. No on-street parking is available in Fort Hancock.

4. Future Conditions

4.1. Adjustments to Existing Volumes

Both peak seasonal weekday and weekend analyses were necessary to address potential impacts to recreational and commuter travel. Therefore, the traffic data collected November 6 –14, 2002 was seasonally adjusted to reflect July automobile usage for both weekend and weekday assessments. Traffic conditions under the Fort Hancock No-Build and Build scenarios were evaluated and compared for both the AM peak hour and the PM peak hour on a weekday, and for the PM peak hour on a weekend. Conditions for mid-summer (July) weekdays represented a worst-case scenario when traffic generated from the development would be greatest. Although not required, PM weekend analyses were conducted as a check. AM peak volumes during the weekend were lower than the other three conditions and, therefore, not examined. The analysis also evaluated traffic conditions assuming that enhanced bus transit opportunities and expanded ferry service would be available after project implementation.

4.2. Future No-Build Traffic Volumes

No-Build volumes for 2008 were estimated by layering background traffic, and anticipated traffic generated from planned development in the area onto estimated 2002 seasonal traffic volumes (See Figures 4-1 through 4-3).

4.2.1. Background Growth

NJDOT's Bureau of Mobility Strategies developed traffic design and pavement design for the proposed project to reconstruct the Route 36 Highlands Bridge over Shrewsbury River using Average Daily Traffic (ADT) estimated for years 2000 and 2008. The data show an annual growth in ADT of about one percent (uncompounded) at the Bridge between 2000 and 2008 (See Appendix J, NJDOT Pavement Design Data). This growth rate was used to estimate background growth along the Route 36 corridor between 2002 and 2008.

4.2.2. Planned Development

Description of Proposed Projects

Route 36 Highlands Bridge over Shrewsbury River: The New Jersey Department of Transportation (NJDOT) is proposing to reconstruct the existing 35 ft. vertical clearance (in the closed position) Bascule Bridge. The bridge is in poor condition, is functionally obsolete, and requires replacement. The preferred reconstruction alternative is currently a 65 ft-high fixed bridge. A bascule bridge

with a 55 ft. vertical clearance in the closed position was also formally considered but not selected as the preferred alternative.

Other Projects: The Monmouth County Planning Board provided a list of all planned development projects (at least 25,000 SF) that are located in communities surrounding the Route 36 corridor. These communities include Hazlet, Holmdel, Matawan, and Middletown Township (See Appendix K, Trip Assignments for Planned Development Projects Surrounding the Route 36 Corridor). Trip generation rates were developed for each planned project based the project type (residential office, etc.), size, and data source, Trip Generation by the Institute of Transportation Engineers (ITE), 6th Edition, 1997. It was assumed that these developments would be completed by 2008, the Project Build year.

The planned construction includes office space and residential space. Residential units are calculated by taking the total project square footage, and dividing by 1500 square feet per unit. Trip assignments for each project are presented in Appendix K. All trips generated in the study area were assigned onto Route 36 in order to present a conservative analysis. The planned development projects are described below:

- Talent Technology Center, Hazlet Township: The Talent Technology Center will be located along the Route 36 corridor, and will occupy 40,000 SF. It is classified as a general office development.

- Palmer Avenue Office Building, Holmdel Township: The Palmer Avenue Office Building will be located along Palmer Avenue between Route 35 and Route 36. The project is classified as general office development and will occupy 25,110 SF.

- Holmdel Corporate Plaza, Holmdel Township: The Holmdel Corporate Plaza will be located near the Route 35 corridor. The project is classified as general office and will occupy 50,780 SF.

- JSM at Matawan, Matawan Borough: JSM at Matawan will be located in the borough of Matawan, which lies west of the GSP and west of the study limits. The project is classified as general office, and will occupy 52,992 SF.

- Regency Park, Middletown Township: Regency Park will be located near the intersection of Route 36 and Grove St. It is classified as a residential development and will encompass 65,786 SF (approximately 44 units).

AM No Build Summer Weekday

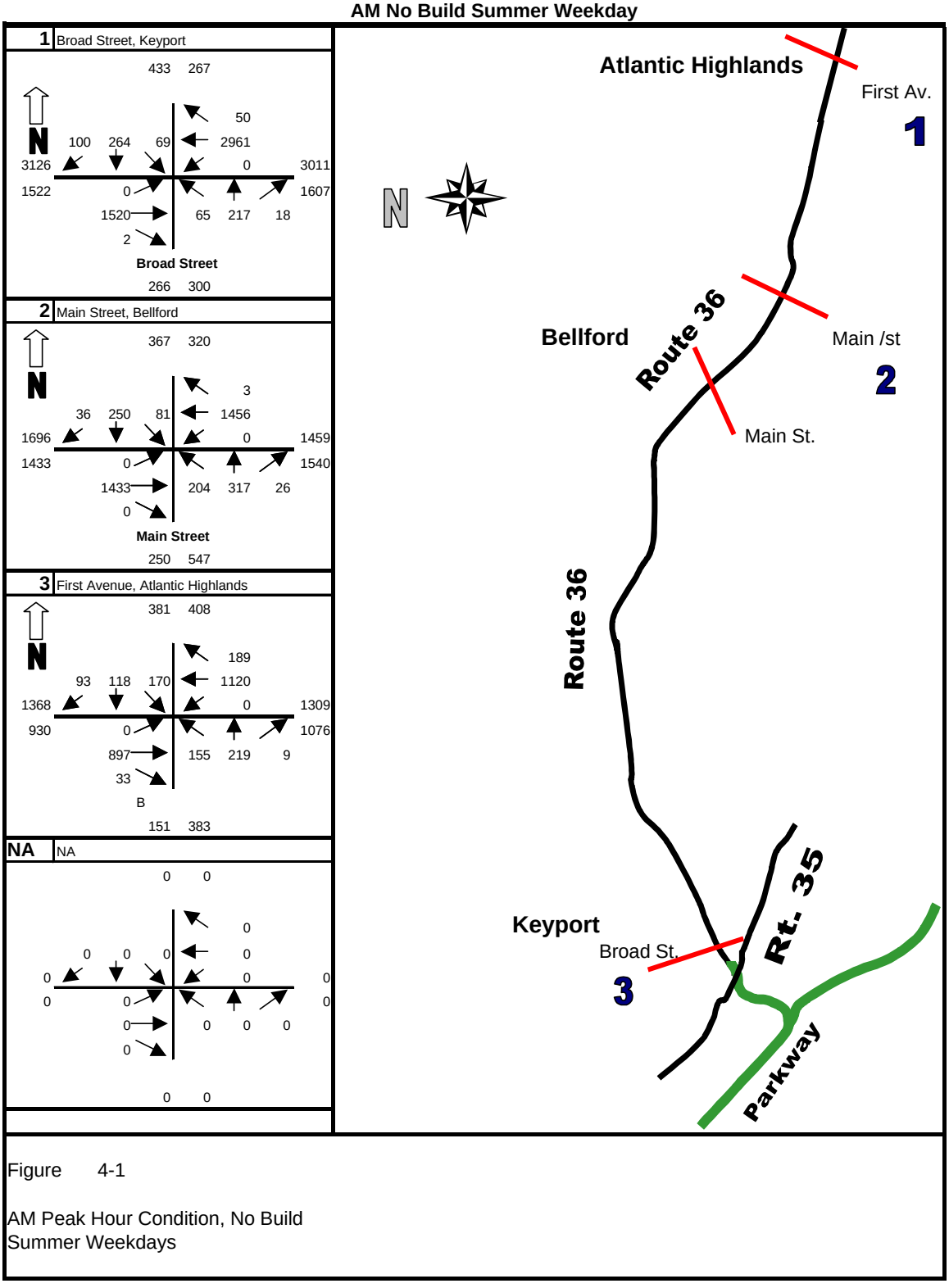


Figure 4-1

AM Peak Hour Condition, No Build
Summer Weekdays

AM No Build Summer Weekday

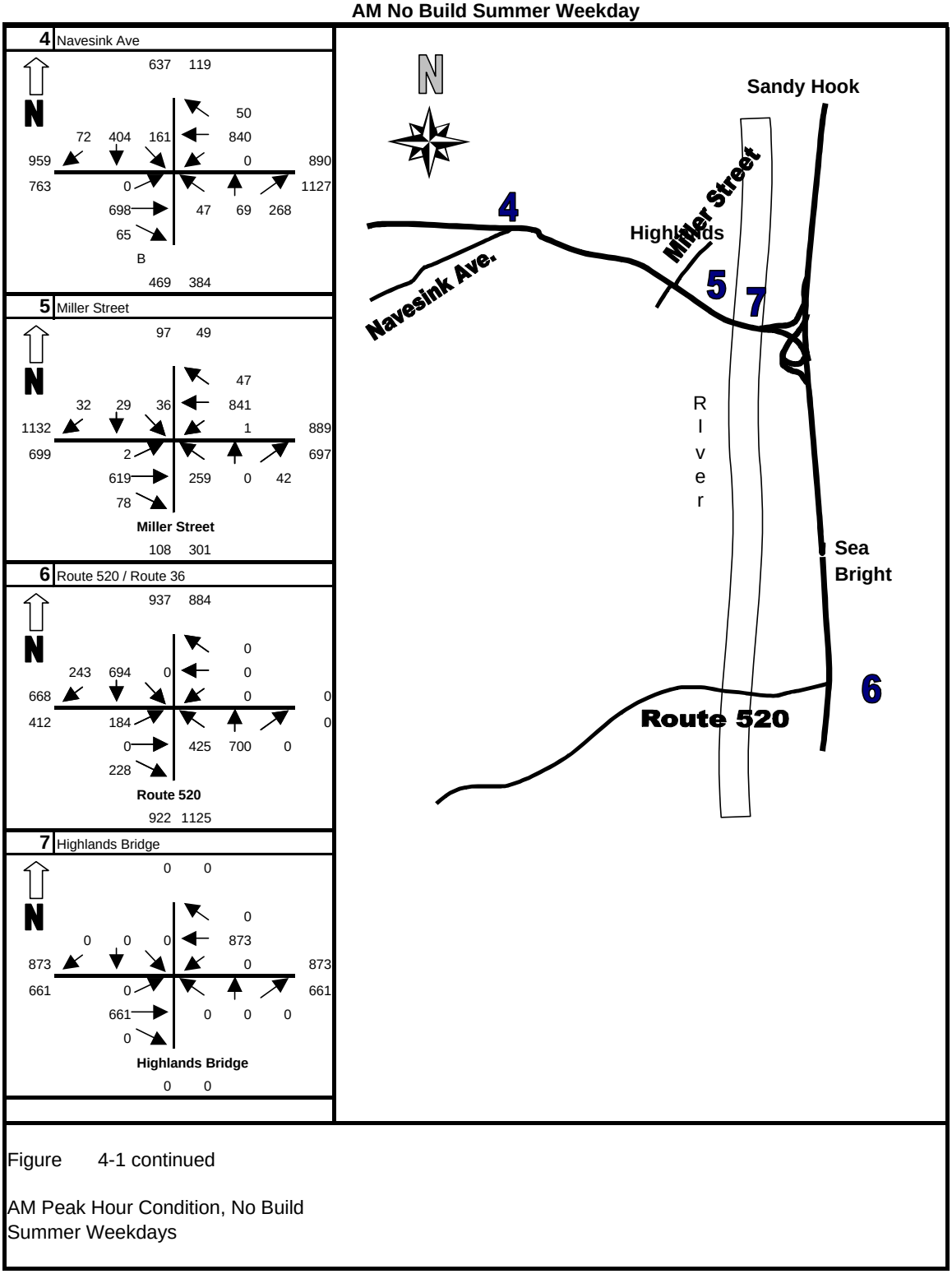


Figure 4-1 continued

AM Peak Hour Condition, No Build
Summer Weekdays

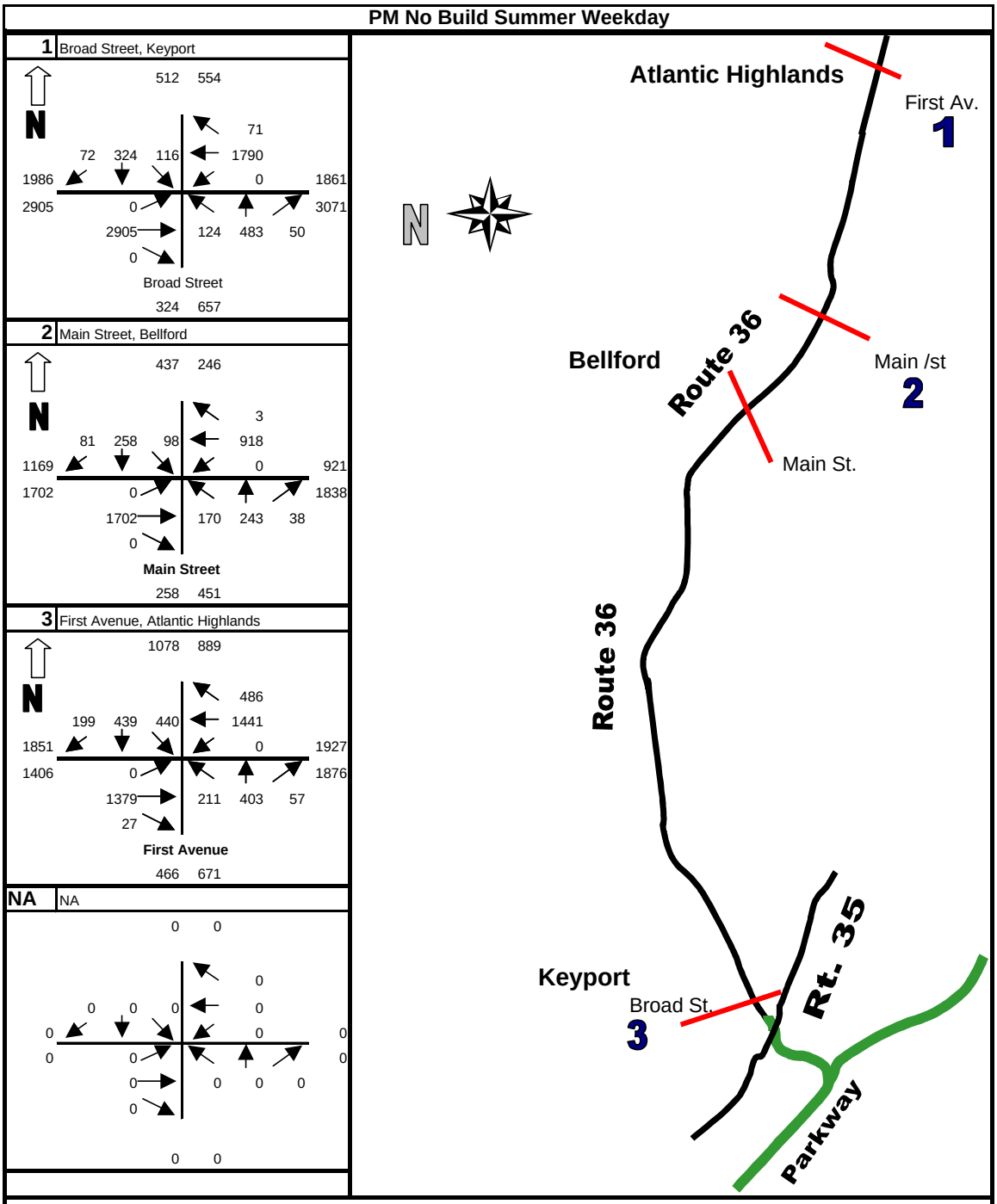


Figure 4-2

PM Peak Hour Condition; No build
Summer Weekdays

PM No Build Summer Weekday

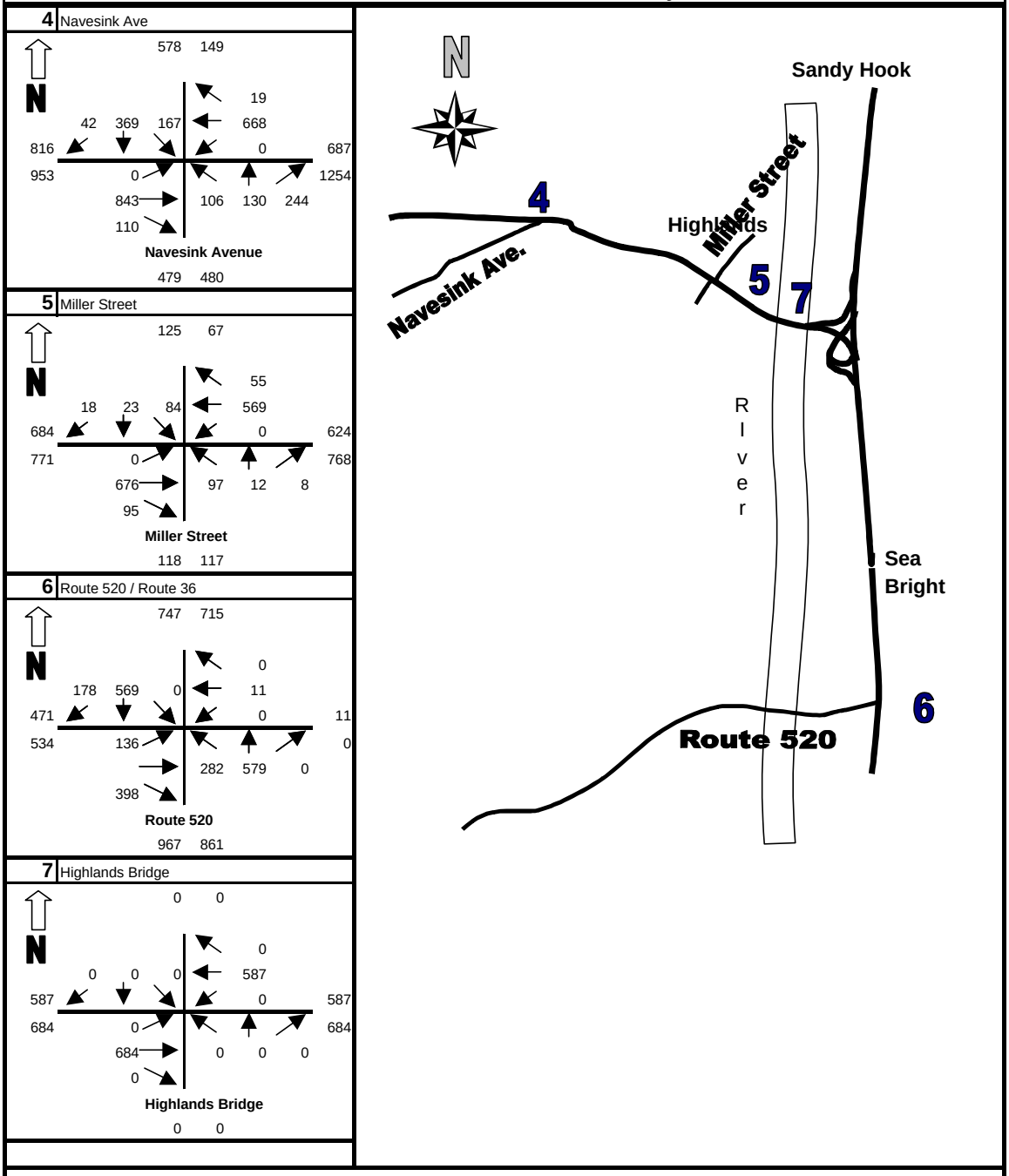


Figure 4-2 continued

PM Peak Hour Condition; No build
Summer Weekdays

PM No Build Summer Weekend

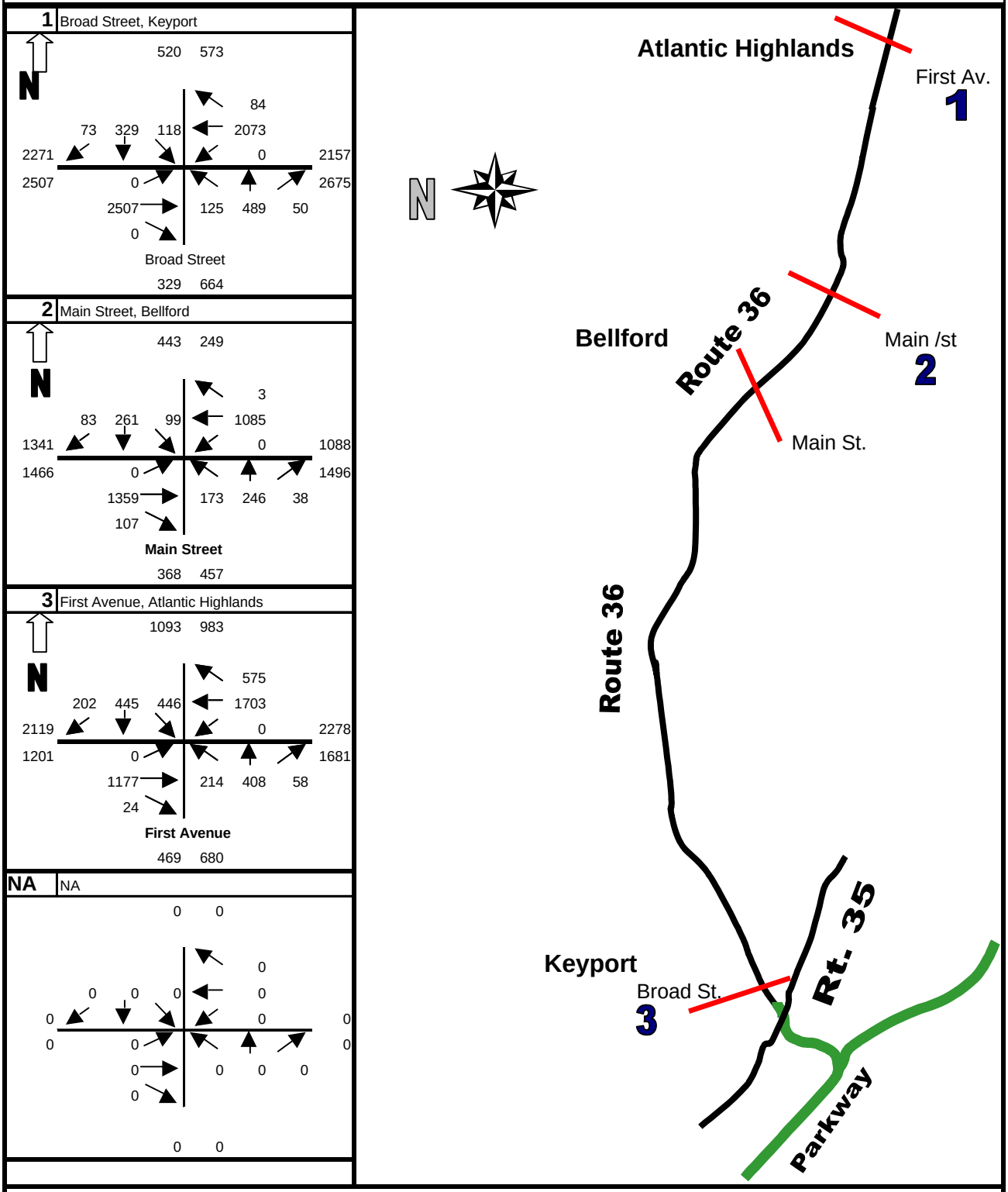
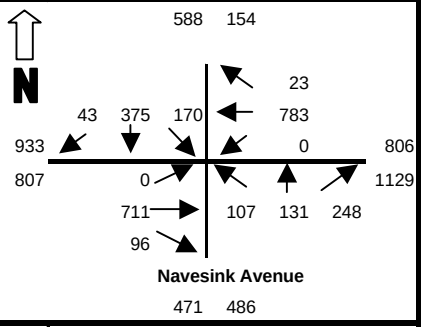


Figure 4-3

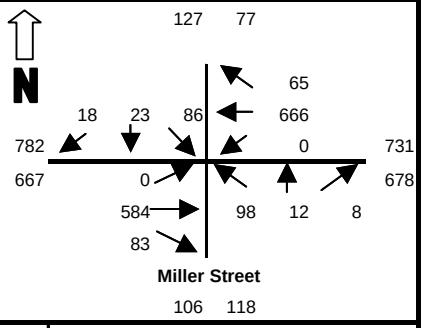
PM Peak Hour Condition; No build
Summer Weekend

PM No Build Summer Weekend

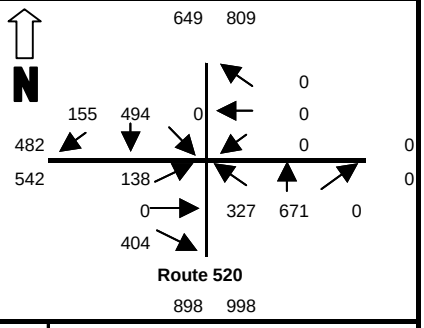
4 Navesink Ave



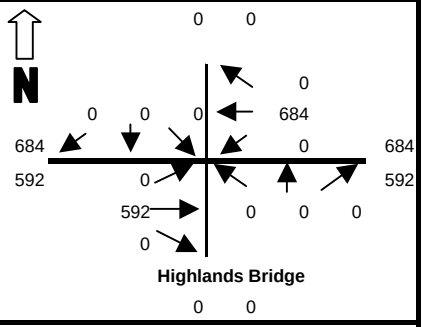
5 Miller Street



6 Route 520 / Route 36



7 Highlands Bridge



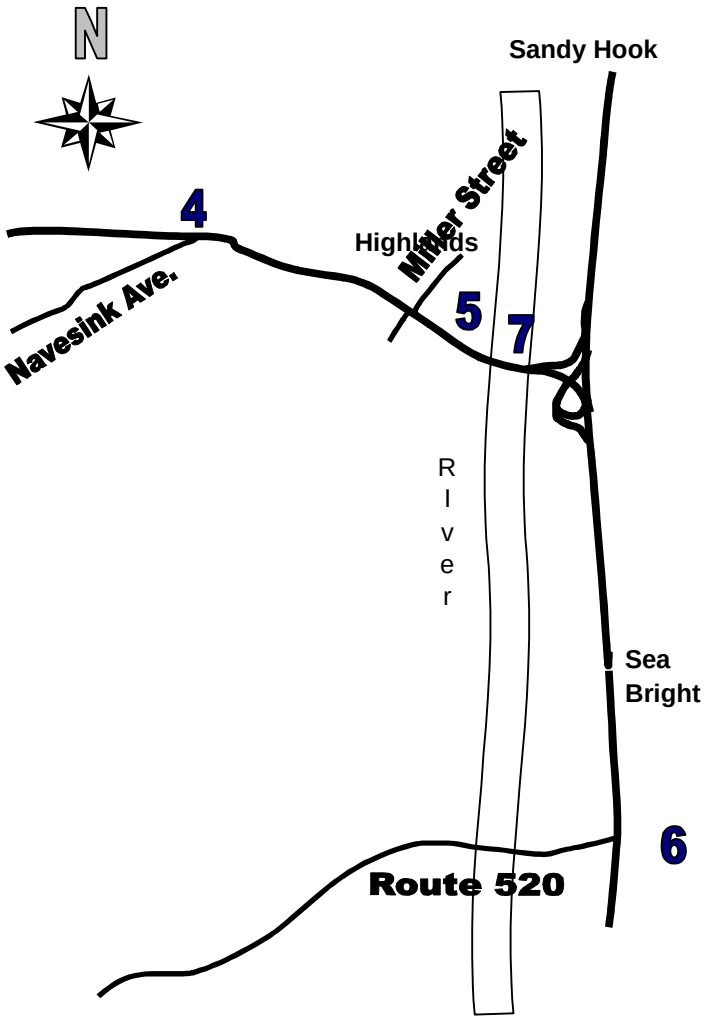


Figure 4-3 continued

PM Peak Hour Condition; No build
Summer Weekend

- Pyramid Equities, Middletown Township: Pyramid Equities will be located along Route 35 and are classified as general office. The project will encompass 41,948 SF.;

- Dunes at Spy House Harbor, Middletown Township: The Dunes will be located near the intersection of Route 36 and Port Monmouth Rd. The project is classified as Residence, and will occupy 125,453 SF (approximately 84 units).

- Gate Cottage at Navesink, Middletown Township: The Gate Cottage project will be located on Navesink Ave. near Route 36. The project is classified as residential and will cover 130,053 SF (approximately 87 units).

- Middletown Senior Housing, Middletown Township: The Senior Housing Development will be located between Lake St. and Orchard Blvd. on Route 36. The project is classified as residential and will cover 173,830 SF (approximately 115 units).

- Wobito, Middletown Township: The Wobito project will be located near the Route 35 corridor. The project is classified as mixed, and will cover 42,062 SF.

- Route 36 Corridor: According to the Monmouth County Planning Board, the current roadway geometry at study area intersections along Route 36 is not expected to significantly change between the present and 2006 the Build year.

Generated Vehicle Trips

Planned-development traffic from the aforementioned development projects, excluding Fort Hancock Leasing Program, was estimated to generate over 200 vehicle trips along Route 36 during each weekday peak hour. On weekends, these projects were estimated to generate about 90 daily trips in both the inbound and outbound directions through the corridor on a July weekend in the afternoon peak hour (See Appendix K).

Considering the proximity of each planned development site to the Route 36 corridor, six of the ten planned projects were estimated to generate traffic along Route 36. The projects that were eliminated from the analysis included;

- Holmdel Corporate Plaza (50,780 sq. ft.)

  Holmdel is located south of Route 36. Holmdel is also situated south of Route 35 except for the Community's northern corner which is situated between Route 35 and Route 36. It was assumed that trips generated from the Holmdel sites would travel along the closest highway corridor, Route 35 rather than Route 36.

- JSM at Matawan (52,992 sq. ft.)

  Matawan is located to the west of the GSP and outside the study area.

- Pyramids Equity (41,948 Sq. ft.) and the Woboto Mixed Development Project (42,062 sq. ft.) in Middletown

  These projects are planned to be located along Route 35 and it was assumed that east west travel for these trips would occur on the Route 35 corridor.

  The vehicle trips generated by the remaining six projects were assigned exclusively along the Route 36 corridor with one exception. The Palmer Building in Holmdel is located on Palmer Avenue which runs between Route 35 and Route 36. Therefore, one-half of the traffic from this project was assigned onto Route 36. The remaining vehicle trips were assumed to travel along Route 35.

  The following chart summarizes the number of trips by peak hour for weekdays and weekends (see ITE trip generation rates in this appendix):

	AM		PM	
	IN	OUT	IN	OUT
WEEKDAY	96	130	128	126
WEEKEND	-	-	89	88

The following directional split was assumed for the traffic assignment: 80 percent of the exiting trips were assigned to the west (toward the GSP) and 20 percent were assigned to the east (to the Route 36 Bridge) to roughly reflect the travel patterns of background traffic in the corridor.

Appendix K presents Figures K-1and K-2, which summarizes the total volume that would be generated by the planned development projects at each study area intersection.

4.3. Alternatives Analysis

Four (4) future traffic scenarios for the implementation during peak hour traffic conditions were analyzed. These scenarios included:

- Alternative 1: Future Null with Existing Bascule Bridge (NPS continues to manage the property according to established policies, standards, and guidelines.)
- Alternative 2 Build Condition with Proposed Fort Hancock Gateway Village (Fort Hancock Gateway Village Proposal is implemented)
- Alternative 3: Build Condition with Enhanced Bus Transit
- Alternative 4: Build Condition with Ferry Service Usage

Future traffic operations on the Route 36 Bridge were also evaluated for alternative river crossing structures and vertical clearances. The following scenarios were assessed:

- No-Build traffic on the existing movable Bridge (bascule span with a vertical clearance of 35 feet in closed position,
- Build traffic on movable bridge with a vertical clearance of 55 feet in closed position,
- Build traffic on fixed bridge with a vertical clearance of 65 feet.

4.3.1. Alternative 1 – Future Null with Existing Bascule Bridge

Weekday Conditions

Traffic would operate at LOS D or better along Route 36 in both directions between the Route 36 Bridge and Main Street in Belford during both weekday peak hours (See Tables 4-1, 4-2). Main Street is located 10 miles away from the Route 36 Bridge.

At the Broad Street/Route 36 intersection, situated 17 miles from the Bridge, traffic along Route 36 would operate at LOS D in the westbound direction during the AM peak hour and LOS E in the eastbound direction during the PM peak hour.

Along Route 36 (Ocean Avenue), the left-turn movement towards the Rumson Bridge would operate at over capacity (LOS F) along the northbound approach during both peak hours. The remaining movements would operate at LOS D or better.

Traffic resulting from area-wide planned developments and background growth would likely increase travel demand on many northbound and southbound approaches that are already operating at or near capacity.

Weekend Conditions

Route 36 traffic between the Route 36 Highlands Bridge and Main Street in Belford would experience LOS D or better conditions during both peak hours. At Broad Street, eastbound traffic would operate at LOS E in the PM peak hour (See Table 4-3).

TABLE 4-1
NO-BUILD TRAFFIC OPERATIONS
WEEKDAY
AM PEAK HOUR

Intersection *Broad St./Route 36*		V/C Ratio	Delay in Seconds	LOS
NB	LT	0.64	60	E
	Thru/RT	0.49	38	D
SB	LT	0.34	36	D
	Thru/RT	0.79	50	D
EB	Thru/RT	0.51	15	B
WB	Thru/RT	1.02	45	D

Intersection *First Ave/Route 36*		V/C Ratio	Delay in Seconds	LOS
NB	LT	0.51	48	D
	Thru/RT	0.72	56	E
SB	LT	0.64	56	E
	Thru/RT	0.8	67	E
EB	Thru/RT	0.39	19	B
WB	Thru/RT	0.56	22	C

Intersection *Miller Street/Route 36*		V/C Ratio	Delay in Seconds	LOS
NB	LT/RT	1.05	105	F
SB	Thru/RT	0.27	36	D
EB	LTR	0.36	12	B
WB	Thru/RT	0.43	12	B

Main Street/Route 36				
NB	LT	1.28	201	F
	Thru/RT	0.74	47	D
SB	LT	0.7	64	E
	Thru/RT	0.62	42	D
EB	Thru	0.67	28	C
WB	Thru	0.68	28	C
	Thru/RT			

Navesink Ave./Rt.36				
NB	LT	0.87	121	F
	Thru/RT	0.14	31	C
SB	LT	0.47	38	D
	Thru/RT	1.01	84	F
EB	Thru	0.35	13	B
WB	Thru/RT	0.43	14	B

Route 520/Route 36				
NB	LT	1.48	271	F
	Thru	0.91	38	D
SB	Thru	0.9	37	D
	RT	0.24	6	A
EB	LT	0.77	54	D
	RT	0.44	22	C

Notes: V/C Ratio = volume to capacity ratio
LOS = level of service

TABLE 4-2
NO-BUILD TRAFFIC OPERATIONS
WEEKDAY
PM PEAK HOUR

Intersection		V/C	Delay in	LOS
Broad St./Route 36		Ratio	Seconds	
NB	LT	0.91	89	F
	Thru/RT	0.99	72	E
SB	LT	2.16	610	F
	Thru/RT	0.74	43	D
EB	Thru/RT	1.09	74	E
WB	Thru/RT	0.79	24	C

Intersection		V/C	Delay in	LOS
First Ave/Route 36		Ratio	Seconds	
NB	LT	0.69	55	E
	Thru/RT	1.46	270	F
SB	LT	1.65	358	F
	Thru/RT	2.38	681	F
EB	Thru/RT	0.59	22	C
WB	Thru/RT	0.83	29	C

Intersection		V/C	Delay in	LOS
Miller Street/Route 36		Ratio	Seconds	
NB	LT/RT	0.39	39	D
SB	Thru/RT	0.39	38	D
EB	LTR	0.4	12	B
WB	Thru/RT	0.3	11	B

Main Street/Route 36				
NB	LT	0.92	94	F
	Thru/RT	0.62	42	D
SB	LT	0.52	57	E
	Thru/RT	0.75	48	D
EB	Thru	0.79	31	C
WB	Thru/RT	0.61	27	C

Navesink Ave./Rt.36				
NB	LT	1.45	299	F
	Thru/RT	0.86	57	E
SB	LT	1.66	374	F
	Thru/RT	0.87	57	E
EB	Thru	0.43	14	B
WB	Thru/RT	0.34	13	B

Route 520/Route 36				
NB	LT	0.98	84	F
	Thru	0.75	26	C
SB	Thru	0.74	26	C
	RT	0.18	5	A
EB	LT	0.57	43	D
	RT	0.78	33	C

Notes: V/C Ratio = volume to capacity ratio
LOS = level of service

TABLE 4-3
NO-BUILD TRAFFIC OPERATIONS
WEEKEND
PM PEAK HOUR

Intersection		V/C	Delay	LOS
Broad St./Route 36				
NB	LT	1.56	341	F
	Thru/RT	1.14	124	F
SB	LT	2.21	633	F
	Thru/RT	0.86	56	E
EB	Thru/RT	0.88	26	C
WB	Thru/RT	0.75	20	C

Intersection		V/C	Delay	LOS
First Ave/Route 36				
NB	LT	0.71	56	E
	Thru/RT	1.48	279	F
SB	LT	1.68	368	F
	Thru/RT	2.42	697	F
EB	Thru/RT	0.5	21	C
WB	Thru/RT	0.98	44	D

Intersection		V/C	Delay	LOS
Miller Street/Route 36				
NB	LT/RT	0.4	39	D
SB	Thru/RT	0.39	38	D
EB	LTR	0.36	11	B
WB	Thru/RT	0.37	12	B

Main Street/Route 36				
NB	LT	0.91	93	F
	Thru/RT	0.62	42	D
SB	LT	0.52	58	E
	Thru/RT	0.76	49	D
EB	Thru	0.68	28	C
WB	Thru/RT	0.51	24	C

Navesink Ave./Rt.36				
NB	LT	1.59	361	F
	Thru/RT	0.87	58	E
SB	LT	1.77	422	F
	Thru/RT	0.88	58	E
EB	Thru	0.36	13	B
WB	Thru/RT	0.4	14	B

Route 520/Route 36				
NB	LT	1.18	147	F
	Thru	0.93	41	D
SB	Thru	0.66	23	C
	RT	0.15	5	A
EB	LT	0.54	42	D
	RT	0.74	31	C

Notes: V/C Ratio = volume to capacity ratio
LOS = level of service

Similar to the weekday condition, the highest levels of congestion would occur along the cross streets, particularly for left-turn maneuvers.

4.3.2. Alternative 2 – Build Condition (Fort Hancock Gateway Village)

The Institute of Transportation Engineers Trip Generation handbook was used to develop trip generation rates for each proposed new use at Fort Hancock.

Project-Generated Traffic

Weekday

Based on ITE Trip Generation rates, the proposed project is estimated to generate 742 trips during the AM peak hour and 563 trips during the PM peak hour on a typical weekday (See Appendix L, Project Trip Generations). Of these totals, 98 AM trips and 130 PM trips were calculated to be generated by restaurant businesses, one of the proposed Gateway Village uses.

Eighty percent of the restaurant-generated trips were considered trips made by customers. These trips were considered to be either local trips made in the immediate vicinity of the project site, or secondary or pass-by trips, that is, vehicle trips which are already on the roads traveling to other destinations but which deviate from their paths to access a secondary destination. As a result, these trips, totaling 182 ((98+130) x .80), were not assigned through the 17-mile study corridor. The remaining restaurant trips (46) were assumed to be new trips made by employees and were routed through all study area intersections. Based on these assumptions, the number of weekday vehicle trips generated by the project was estimated to be 664 in the AM peak hour and 459 in the PM peak.

Weekend (July Saturday/Sunday)

The number of project-generated trips was calculated to be 314 during the afternoon peak hour on a July weekend. Of this total, 108 were estimated to be made by restaurant patrons, resulting in 206 project-generated vehicle trips (314-108).

Assignments for Project-Generated Traffic

To present the most conservative analysis (estimating maximum theoretical impacts), both weekday and weekend vehicle trips were routed either through the Route 36 corridor as far west as the GSP (17 miles from the project site) and as far south as Route 520 (5 miles south of the project site). Both Route 36 and Route 520 cross the Shrewsbury River and provide access to the Sandy Hook Park. Ninety percent of the trips were assigned from the west along Route 36

and the remaining 10 percent were assigned along Route 36 (Ocean Avenue) from the south. Some adjustments were made to reflect the distribution of trip lengths. For example, it is expected that 50% of traffic headed westbound on Route 36 from the Park will have arrived at their destinations before reaching the GSP. These percentages reflect the level of current traffic activity along each corridor.

Trip distance was also considered. For example, it is highly unlikely that all drivers exiting westbound from Sandy Hook would have destinations as far as the Garden State Parkway. The average travel time for work related trips in Monmouth County, based on 2000 census data, is approximately 30 minutes. Assuming a 30-minute travel time from Sandy Hook to the Parkway (17 miles), then half the westbound trips would arrive at destinations east of The Parkway, and therefore not use the Parkway.

Traffic Impacts

Weekday

The build condition traffic volumes are illustrated in Figures 4-4 and 4-5. LOS conditions resulting from the build traffic are presented in Table 4-4 and 4-5. The proposed project is not expected to significantly affect traffic operations along Route 36 during the AM peak hour. After the Fort Hancock project is implemented, traffic would still operate at LOS D or better along Route 36's east and west approaches at all study area intersections and along the northbound and southbound approaches of Route 36 at Route 520.

Congestion at the intersection of Route 36 at Broad Street results from Route 36's dual function. It serves county-wide traffic activity and recreational traffic both inside and outside the region. In the PM peak hour, 100 vehicles generated by planned development (e.g. projects that have already been approved by Monmouth County), would exacerbate current levels of delay along Route 36 eastbound at Broad Street. Traffic operations would deteriorate from LOS D (Existing) to LOS E (No-Build). Project-generated traffic (80 vehicles), when added to the planned development traffic (100 vehicles) would reduce the LOS further from an E condition to an F condition.

Weekend

The proposed project is not expected to generate significant impacts along the study corridor. After project implementation, LOS D or better would be maintained along all eastbound and westbound approaches of Route 36 and along the northbound and southbound approaches of Route 36 at Route 520 (See Figure 4-6 and Table 4-6).

TABLE 4-4
BUILD TRAFFIC OPERATIONS
WEEKDAY
AM PEAK HOUR

Intersection		V/C Ratio	Delay in Seconds	LOS
Broad St./Route 36				
NB	LT	0.64	60	E
	Thru/RT	0.49	38	D
SB	LT	0.34	36	D
	Thru/RT	0.79	50	D
EB	Thru/RT	0.61	16	B
WB	Thru/RT	1.05	54	D

Intersection		V/C Ratio	Delay in Seconds	LOS
First Ave/Route 36				
NB	LT	0.51	48	D
	Thru/RT	0.72	56	E
SB	LT	0.64	56	E
	Thru/RT	0.8	67	E
EB	Thru/RT	0.59	22	C
WB	Thru/RT	0.6	23	C

Intersection		V/C Ratio	Delay in Seconds	LOS
Miller Street/Route 36				
NB	LT/RT	1.05	106	F
SB	Thru/RT	0.27	36	D
EB	LTR	0.59	15	B
WB	Thru/RT	0.48	13	B

Main Street/Route 36				
NB	LT	1.28	202	F
	Thru/RT	0.74	47	D
SB	LT	0.7	64	E
	Thru/RT	0.62	42	D
EB	Thru	0.88	36	D
WB	Thru	0.73	29	C
	Thru/RT			

Navesink Ave./Rt.36				
NB	LT	0.87	121	F
	Thru/RT	0.14	31	C
SB	LT	0.47	38	D
	Thru/RT	1.01	84	F
EB	Thru	0.59	17	B
WB	Thru/RT	0.48	15	B

Route 520/Route 36				
NB	LT	1.48	271	F
	Thru	0.98	50	D
SB	Thru	0.92	39	D
	RT	0.24	6	A
EB	LT	0.77	54	D
	RT	0.44	22	C

Notes: V/C Ratio = volume to capacity ratio
LOS = level of service

TABLE 4-5
BUILD TRAFFIC OPERATIONS
WEEKDAY
PM PEAK HOUR

Intersection		V/C	Delay in	LOS
Broad St./Route 36		Ratio	Seconds	
NB	LT	0.91	89	F
	Thru/RT	0.99	72	E
SB	LT	2.16	610	F
	Thru/RT	0.74	43	D
EB	Thru/RT	1.13	90	F
WB	Thru/RT	0.76	23	C

Intersection		V/C	Delay in	LOS
First Ave/Route 36		Ratio	Seconds	
NB	LT	0.69	55	E
	Thru/RT	1.46	270	F
SB	LT	1.65	350	F
	Thru/RT	2.38	681	F
EB	Thru/RT	0.65	24	C
WB	Thru/RT	0.93	36	D

Intersection		V/C	Delay in	LOS
Miller Street/Route 36		Ratio	Seconds	
NB	LT/RT	0.39	39	D
SB	Thru/RT	0.39	38	D
EB	LTR	0.47	13	B
WB	Thru/RT	0.42	12	B

Main Street/Route 36				
NB	LT	0.92	94	F
	Thru/RT	0.62	42	D
SB	LT	0.52	57	E
	Thru/RT	0.75	48	D
EB	Thru	0.86	34	C
WB	Thru/RT	0.78	32	C

Navesink Ave./Rt.36				
NB	LT	1.45	299	F
	Thru/RT	0.86	57	E
SB	LT	1.66	374	F
	Thru/RT	0.87	57	E
EB	Thru	0.5	15	B
WB	Thru/RT	0.46	13	B

Route 520/Route 36				
NB	LT	0.98	84	F
	Thru	0.77	27	C
SB	Thru	0.77	27	C
	RT	0.18	5	A
EB	LT	0.57	43	D
	RT	0.78	33	C

Notes: V/C Ratio = volume to capacity ratio
LOS = level of service

TABLE 4-6
BUILD TRAFFIC OPERATIONS
WEEKEND
PM PEAK HOUR

Intersection		V/C Ratio	Delay in Seconds	LOS
Broad St./Route 36				
NB	LT	1.56	341	F
	Thru/RT	1.14	124	F
SB	LT	2.21	633	F
	Thru/RT	0.86	56	E
EB	Thru/RT	0.92	28	C
WB	Thru/RT	0.77	21	C

Intersection		V/C Ratio	Delay in Seconds	LOS
First Ave/Route 36				
NB	LT	0.71	56	E
	Thru/RT	1.48	279	F
SB	LT	1.68	368	F
	Thru/RT	2.42	697	F
EB	Thru/RT	0.54	21	C
WB	Thru/RT	1.01	50	D

Intersection		V/C Ratio	Delay in Seconds	LOS
Miller Street/Route 36				
NB	LT/RT	0.4	39	D
SB	Thru/RT	0.39	38	D
EB	LTR	0.41	12	B
WB	Thru/RT	0.41	12	B

Main Street/Route 36				
NB	LT	0.91	93	F
	Thru/RT	0.62	42	D
SB	LT	0.52	58	E
	Thru/RT	0.76	49	D
EB	Thru	0.72	29	C
WB	Thru/RT	0.54	25	C

Navesink Ave./Rt.36				
NB	LT	1.59	361	F
	Thru/RT	0.87	58	E
SB	LT	1.77	422	F
	Thru/RT	0.88	58	E
EB	Thru	0.41	14	B
WB	Thru/RT	0.43	14	B

Route 520/Route 36				
NB	LT	1.14	132	F
	Thru	0.89	35	D
SB	Thru	0.65	23	C
	RT	0.15	5	A
EB			43	
	LT	0.58	42	D
	RT	0.79	34	C

Notes: V/C Ratio = volume to capacity ratio
LOS = level of service

AM Build Summer Weekday

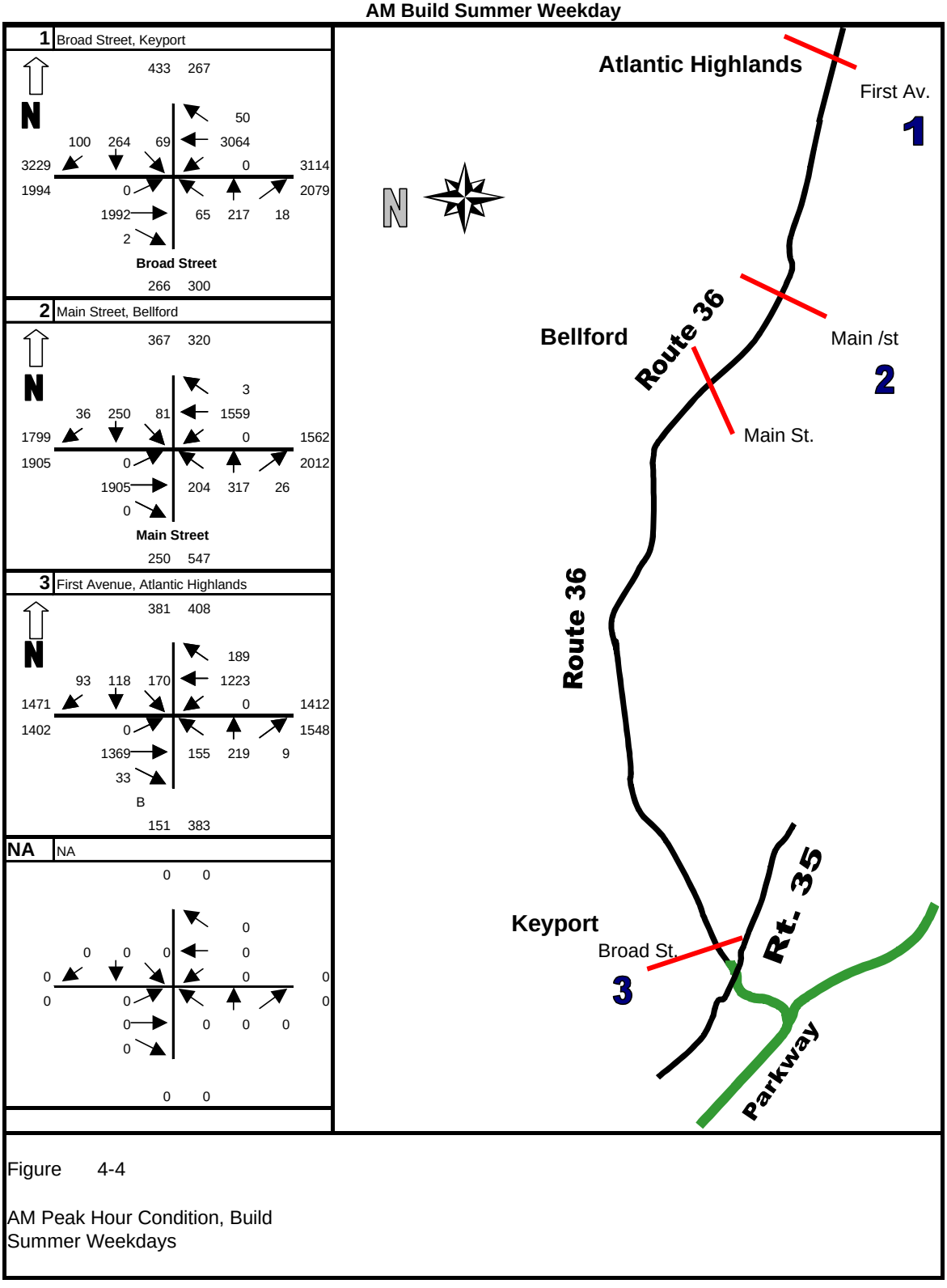


Figure 4-4

AM Peak Hour Condition, Build
Summer Weekdays

AM Build Summer Weekday

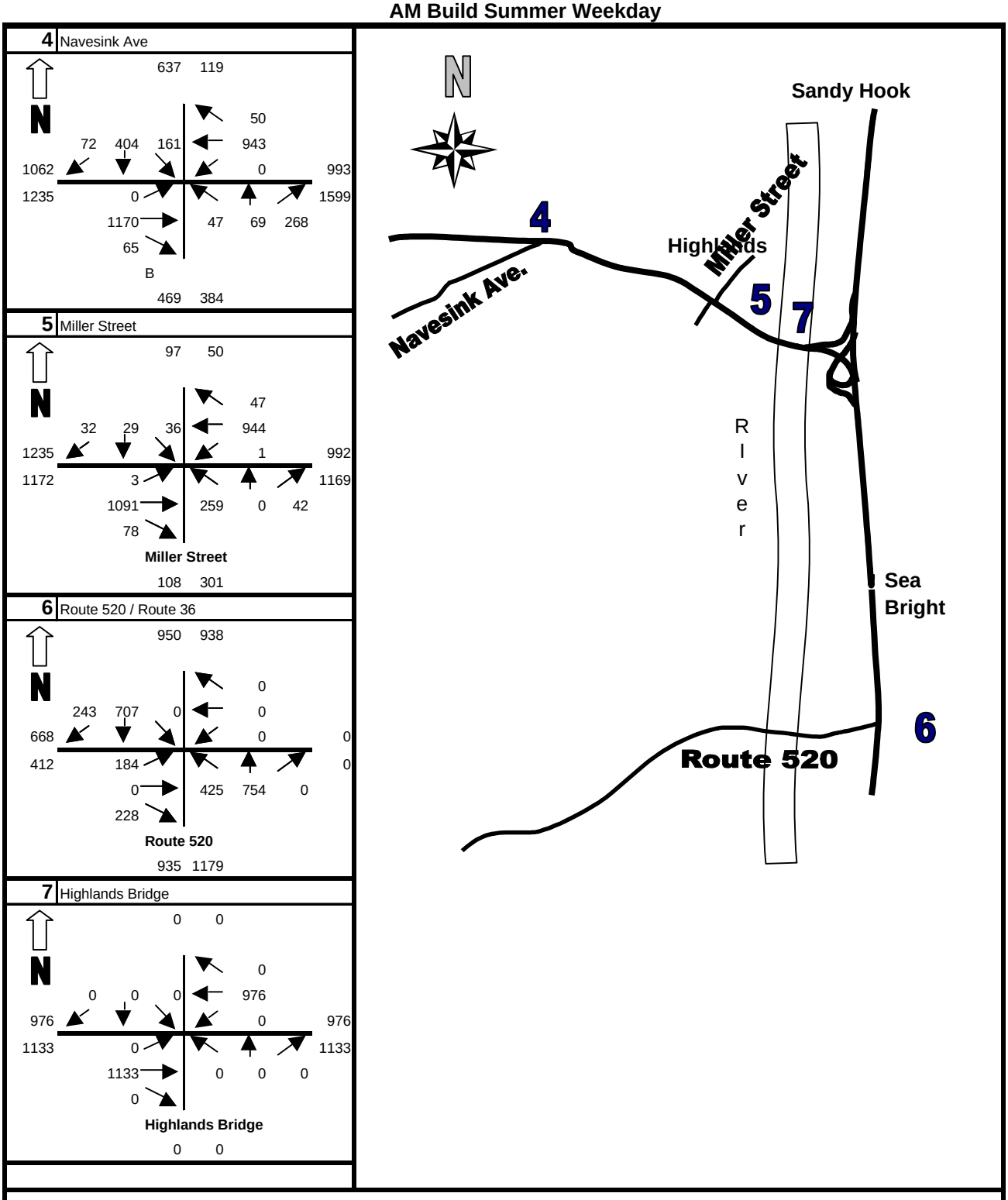


Figure 4-4 continued

AM Peak Hour Condition, Build Summer Weekdays

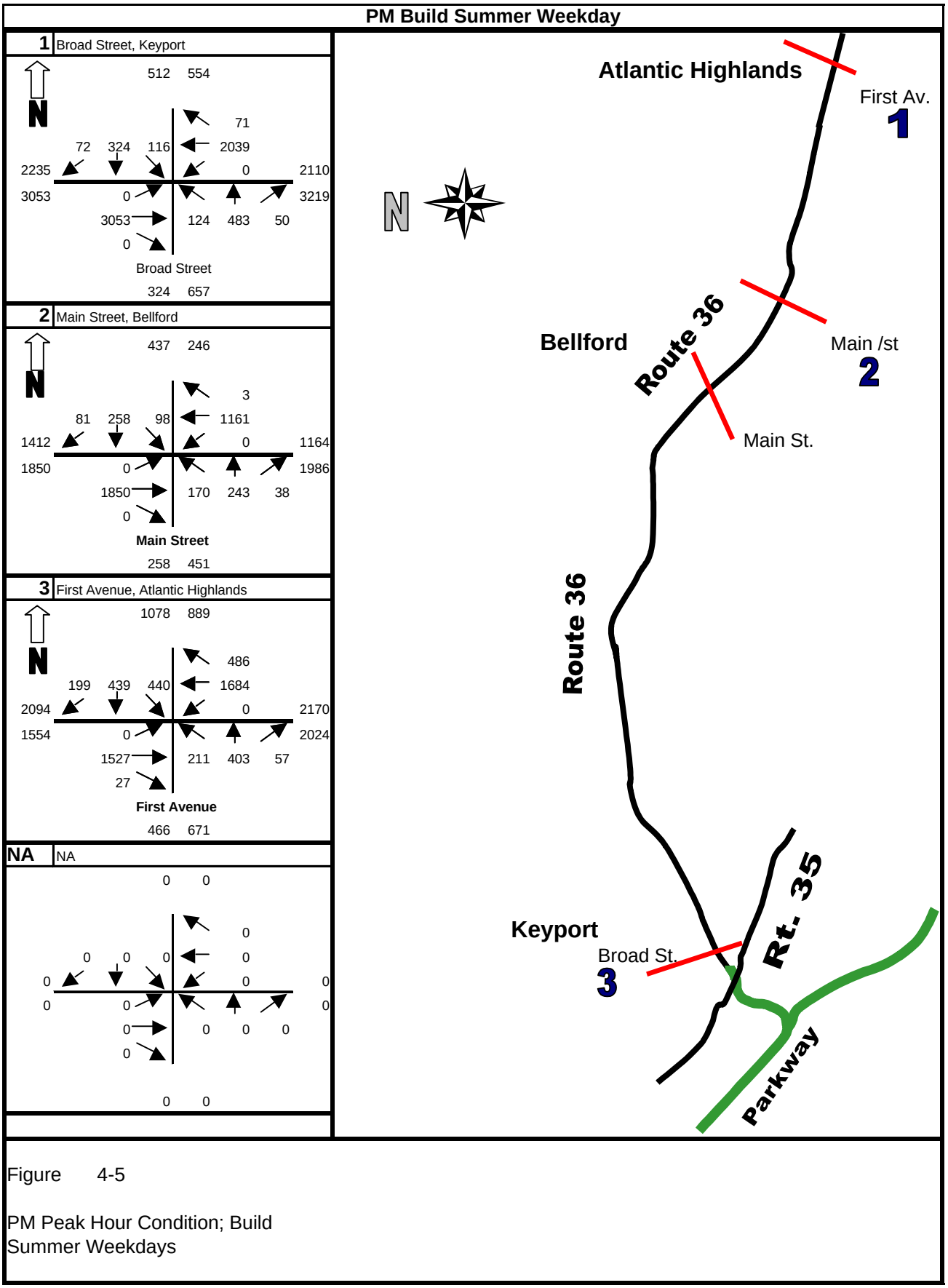
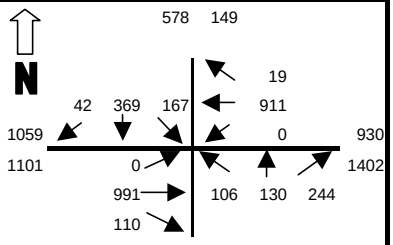


Figure 4-5

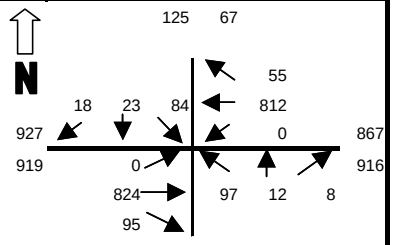
PM Peak Hour Condition; Build
Summer Weekdays

PM Build Summer Weekday

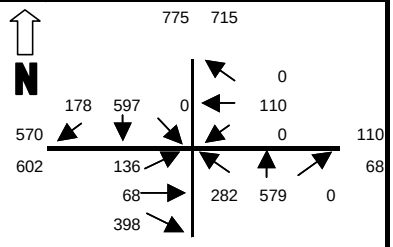
4 Navesink Ave



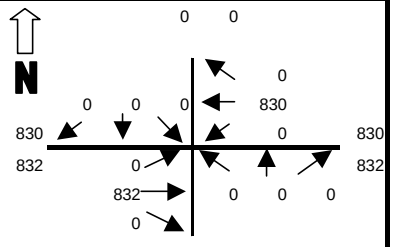
5 Miller Street



6 Route 520 / Route 36



7 Highlands Bridge



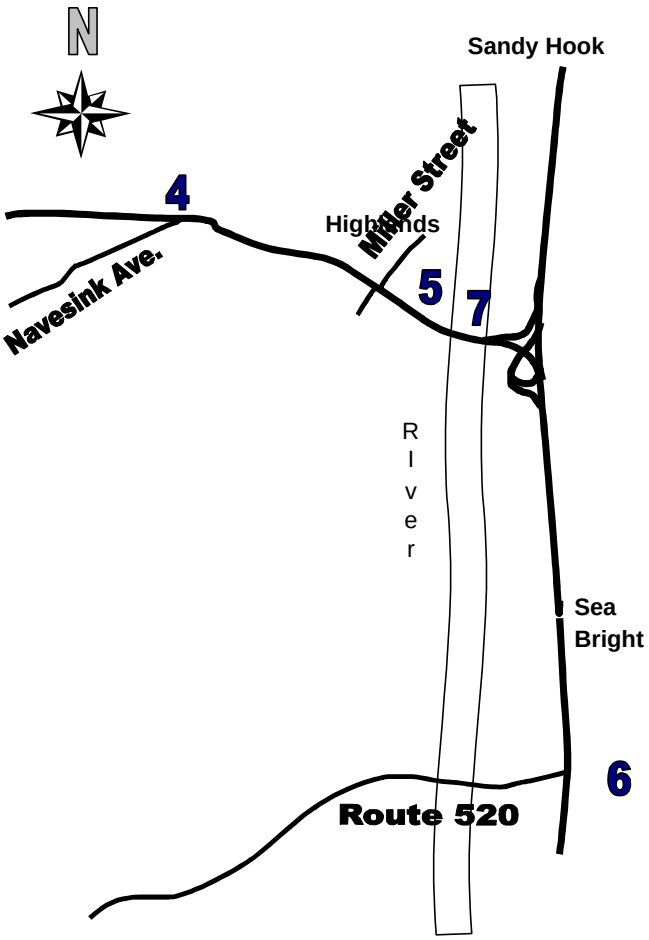


Figure 4-5 continued

PM Peak Hour Condition; Build
Summer Weekdays

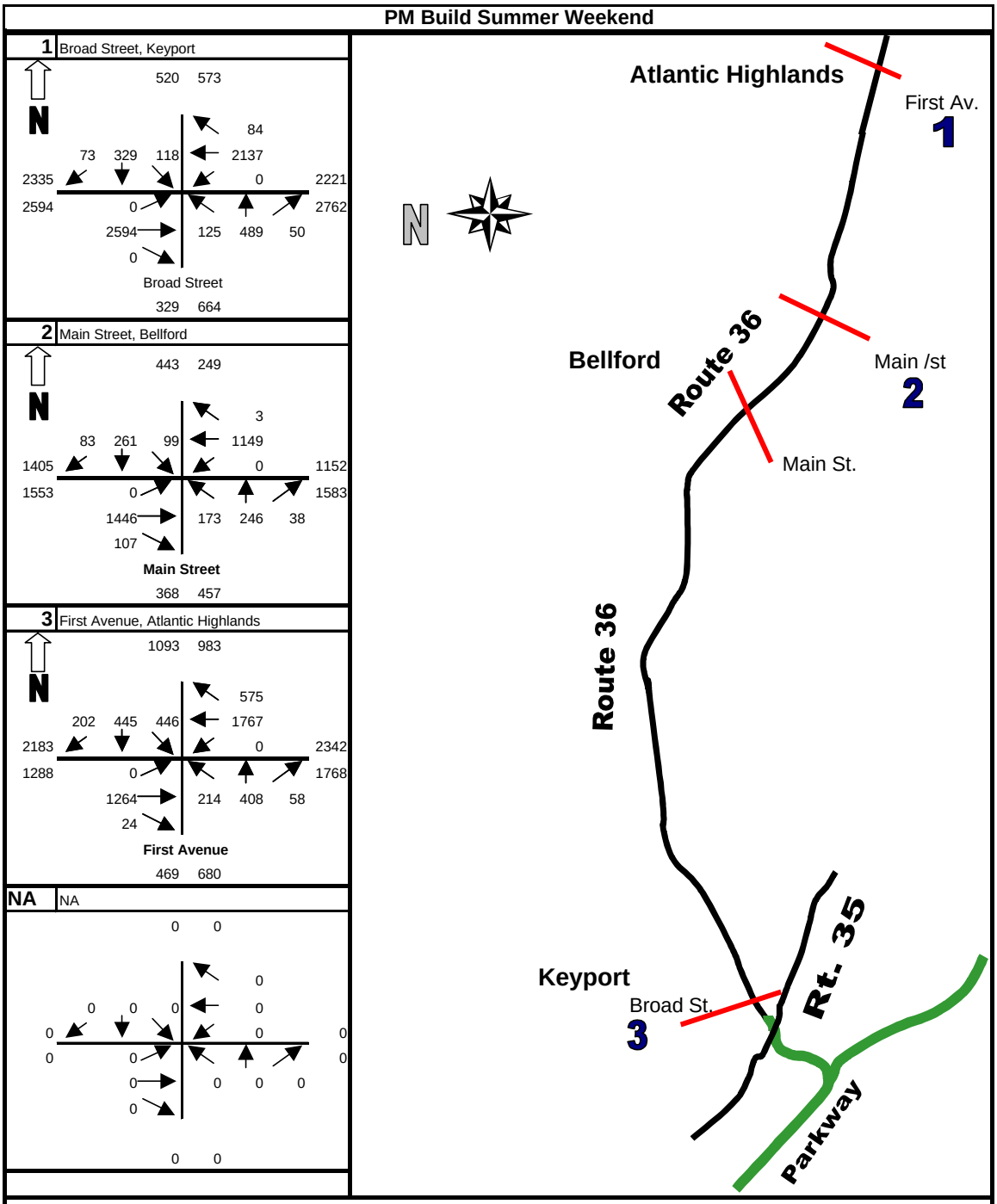
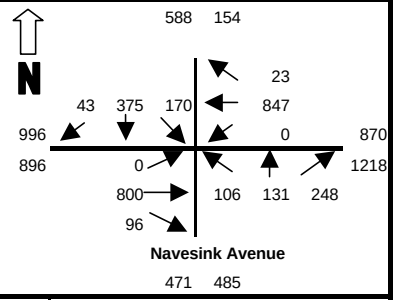


Figure 4-6

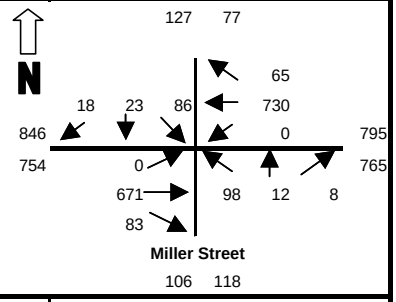
PM Peak Hour Condition; Build
Summer Weekends

PM Build Summer Weekend

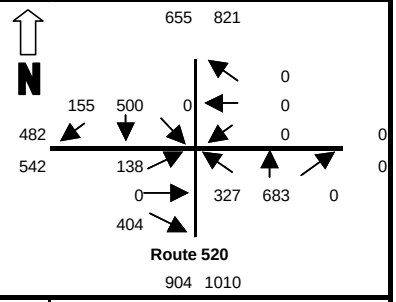
4 Navesink Ave



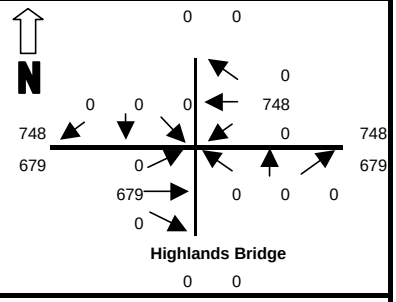
5 Miller Street



6 Route 520 / Route 36



7 Highlands Bridge



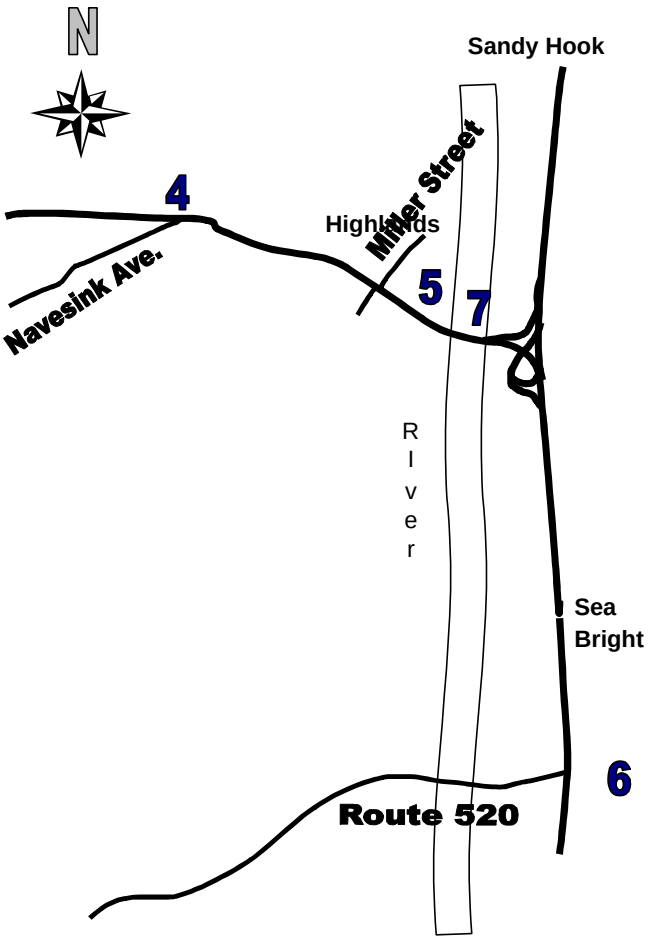


Figure 4-6 continued

PM Peak Hour Condition; Build
Summer Weekends

4.3.3. Alternative 3 – Build Condition with Enhanced Bus Transit

The Northern Monmouth County Chamber of Commerce reports that, according to the U.S. Census Bureau, approximately five percent of the northern Monmouth County workforce commutes by bus. It was assumed that if transit opportunities are expanded in the County to include improved access to Sandy Hook Park, either by adding a new bus lines or by modifying the current routes, then five percent of the project generated trips would be made by bus, reflecting current travel patterns.

A reduction of 33 weekday project trips (664x.05) in the AM peak hour and 23 weekday project trips (459x.05) in the PM peak hour could result from expanded bus services. Fewer project-generated vehicles would reduce the amount of additional delay along Route 36, including the Broad Street location. However, LOS F conditions would remain along the Route 36 eastbound direction at Broad Street in the PM peak hour, even with the reduced traffic flow.

4.3.4. Alternative 4 – Build Condition with Ferry Service Usage

The Northern Monmouth County Chamber of Commerce reports that, according to the U.S. Census Bureau, approximately one-half percent of the northern Monmouth County workforce commutes by ferry. The number of project-generated trips switching from auto to ferry mode would be insignificant if travel activity associated with the Gateway Village project reflects current ferry usage.

4.3.5. Traffic Operations on the Bridge

The analysis of the three future conditions for the bridge is based upon projected traffic numbers for 2008. The existing 35’ bascule bridge generally opens two times an hour between May 30 and September 15, causing significant traffic delays. A worst-case evaluation of average vehicle delay in minutes was completed using a model that predicts delay, starting with the highest peak hour and then factoring down fro the second highest peak hour, third highest peak hour, etc. The analysis focused on the AM peak hour traffic volumes for a summer weekday. This is the hour when the highest hourly volumes occur crossing the Bridge. The analysis studied the effect on average vehicle delay resulting from the opening pattern for a bascule bridge with a 35-foot clearance (two openings per hour), bascule bridge with a 55-foot vertical clearance (assumed one opening per hour), and zero opening events for a 65’ fixed bridge. The data results from the future conditions were then compared to the existing bridge condition (See Table 4-7).

The current average vehicle delay across the existing 35-foot bascule bridge is 4.70 minutes during the AM peak hour, weekday condition. Projected 2008 traffic crossing the bridge would result in an average vehicle delay of 4.82 minutes without the proposed project and 5.47 minutes with the proposed project when the bridge is opened. This represents an increase of about 40 seconds per vehicle, or 13 percent.

The two "build" options for a future bridge condition both decrease daily traffic delay with respect to existing conditions. The 55' bascule bridge would result in average vehicle delay to decline to 4.24 minutes without the project and 4.57 with the project. Compared to the no-build condition, the build condition (with the Fort Hancock Rehabilitation Project) would result in an increase of about 20 seconds, or less than 7 percent, per vehicle.

The most likely future scenario will be construction of a 65-foot fixed structure. This alternative would result in no vehicle delay associated with bridge operations. NJDOT has selected a consultant to develop preliminary plans for the 65-foot fixed-bridge alternative. Agreement has been obtained from the Highlands, Sea Bright, and National Parks communities for this alternative. NJDOT's Feasibility Assessment Report is expected to be released in the Spring of 2003.

4.3.6. Local Street Diversion

Significant diversion is not expected because of the proposed development. The source for local diversion would have to be either (1) newly generated local trips, or (2) traffic seeking to avoid delays on major facilities (such as Route 36).

Newly Generated Trips

The project is expected to generate up to approximately 160 trips in weekday summer evenings (worst case) outbound. Examining the outbound trips, assuming 20 percent of these 160 trips are locally bound, then some 32 vehicles could be distributed among local roadways in the weekday peak evening hour. Within a two-mile radius of the park entrance, three local streets might distribute those local trips:

- Bay Avenue
- Miller Street
- Navasink Avenue

Distributing these 32 outbound vehicles among the three intersection results in approximately ten vehicles per intersection in the peak hour. These would split to each intersecting approach, resulting in about five vehicles entering the local

collector streets per hour. Another five per hour might be assumed exiting the local collector streets per hour. In other words, a maximum of ten additional vehicles per hour might result on local collector roads. Based on traffic counts taken at Miller Street, this would add ten vehicles to an expected 192 vehicles, or approximately five percent. For Navesink Avenue, the ten vehicles would be added to an expected 1059 vehicles, or less than one percent. Bay Avenue experiences no less than 350 vehicles each direction in the PM peak hour. An addition of ten vehicles to the traffic stream would represent a three percent increase.

It is also likely that some of these "new" trips would actually be substitute trips - for example, local residents who may have worked elsewhere in the past now working at the Fort Hancock rehabilitation. In those cases, the trips would not be additional trips, only replacement trips. Finally, any assignment to local roadways would improve performance along Route 36 itself. Therefore, the impact from diversion of locally generated trips is not expected to be significant.

Traffic Avoiding Delays

The analysis of representative intersections indicated that even with a full assignment of traffic to Route 36, intersection performance would not significantly deteriorate. Therefore, there would normally be no reason for vehicles to divert to local roadways. In order for trips to divert to local side streets, travel times along those diversion routes would have to be faster or perceived faster than for Route 36. However, the design and posted speeds on nearby Highlands' roadways are slow compared to those on Route 36. Traffic may be occasionally observed diverting from Route 36 to local routes when there are severe back-ups or incidents on Route 36. As for Sea Bright, there simply are no alternative diversion routes around Route 36. In addition, with the Highlands Bridge being replaced with a fixed bridge, severe back-ups would be reduced, and along with them the instances of diversions to local roadways.

Table 4-7

Average Vehicle Delay Resulting From Bridge Opening

Highest Peak Hour (AM Peak Hour, Weekdays)

Type of Bridge	Year	Development Status	Average Vehicle Delay (minutes)
35' Movable	2002	Existing	4.70
	2008	No-Build	4.82
		Build	5.47
55' Movable	2002	Existing	N/A
	2008	No-Build	4.24
		Build	4.57
65' Fixed	2002	Existing	N/A
	2008	No-Build	0.0
		Build	0.0

5. Conclusion

The study found that the AM and PM peak hours on a summer weekday were the critical time periods for assessing the potential impact of the Fort Hancock rehabilitation on traffic operations. The traffic Levels of Service (LOS) at the Route 36 intersection approaches studied are generally "D" or better in both directions. The most congested location along Route 36 was the Broad Street intersection, through which traffic destined for the GSP is processed. The intersection approaches along the local streets tend to have poor LOS's because they are not given signal priority, particularly for the left-turn movements.

The future no-build condition includes all future planned development projects of record in the area plus background growth, less the Fort Hancock rehabilitation proposal. The results show that LOS for Route 36 approaches would decline to D at several locations, including at Broad Street (westbound direction, weekday, AM peak hour), at Main Street (westbound direction, weekday, AM peak hour), and at Route 520 (northbound and southbound directions, weekday, AM peak hour). LOS would decline from D to E along the Route 36 eastbound approach at Broad Street during the PM peak hour. LOS at local street approaches would also decline.

The Fort Hancock contribution to the lowering of LOS at Broad Street is less than the contribution from development projects that are already progressing.

Adding traffic during the peak hour would increase average vehicle delay at the Route 36 Highlands Bridge during openings. The 35-foot clearance bascule bridge is scheduled for replacement with a 65-foot clearance fixed bridge. If no replacement occurs, then delays in the highest peak hour of the day would increase about 20 seconds between the no-build and build condition. However, the most likely scenario is that a new fixed bridge will be constructed, resulting in zero minutes of delay on the bridge under any development scenario.